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EPIDEMIOLOGY TODAY.[1]

By F. M. BURNET, F.R.S.,

Research Professor of Experimental Medicine, University of Melbourne; Director, Walter and Eliza Hall Institute of Pathology and Medicine, Melbourne.

THE subject matter of epidemiology has always been a topic of absorbing human interest and there has never been a period without its historians of epidemics and its students of their causes. All through history, infectious disease, in the form of either short lasting pestilence or drawn-out depopulating unhealthiness, has ranked with war and famine as one of the major human calamities. Every great plague and many lesser ones are on record, and from the time of Thucydides onwards there have been detailed though perhaps not always accurate accounts of the clinical character and extent of each of the great historical epidemics.

Speculation about the nature of infectious disease, some of it intelligent like that of Frascatorius in the sixteenth century and Sydenham in the seventeenth, but most of it sheer nonsense, continued through the centuries. Then in the first half of the nineteenth century there came the great field epidemiologists who prepared the ground for the acceptance of the germ theory at the end of the period. Men like Laennec, Budd, Snow and Chadwick not only sorted out the main clinical types of infectious disease, but by the use of simple commonsense reasoning, showed in, for example, the instances of typhoid fever and cholera that the agent responsible was spread by water which had been contaminated with excreta from patients with the disease. The further deduction that the poison or virus of the disease must multiply in the body of the patient was more or less clearly stated well before Pasteur and Koch laid the foundations of bacteriology. When many of the important microorganisms of disease were discovered in the eighties and nineties, epidemiological work took on a new interest, and combined field and laboratory study became the standard type of approach to an epidemiological problem. So for more than fifty years there has been active and effective study of epidemiological happenings.

The question may arise, as it too often does in Australia: "What is there left to do in epidemiology in this country which has not been done already, or which is not now being done elsewhere with better facilities than we possess?" There are two ways of answering this question. The first is to point to what has actually been done in epidemiology in Australia within recent years.

The outstanding achievement of opening up a whole new concept in epidemiology, that of congenital disease due to infection of the fœtus during the early months of pregnancy, must be credited to an Australian, Gregg. An American epidemiologist told me that Gregg's recognition of the relation between German measles in the first three months of pregnancy and congenital defects in the child was the finest piece of what the Americans call "shoe-leather" epidemiology of the century. The lead opened up by this Australian work has been developed by Swan and other workers in this country, and is now being confirmed overseas.

Next we should take some pride in the story of the first recognition of the nature of two important rickettsial diseases, murine typhus and "Q" fever. The rickettsiæ are microorganisms spread by insect or other arthropods which cause typhus fevers of various types. The typhus of Eastern Europe or of the gaols and prison hulks of the eighteenth century in England is the classical form of the disease and is transferred by the body louse.

[1] The inaugural lecture of the Research Professor of Experimental Medicine in the University of Melbourne, delivered on October 10, 1946.

It was known for many years that isolated cases of typhus might occur in patients perfectly free from lice, but the first indication of the origin of such cases was provided by Dr. F. S. Hone, of Adelaide, in 1921. He described cases in wharf lumpers dealing with the wheat that had accumulated during the war years, and recognized their probable association with mice or rats. The full story of the transmission of the disease from rats and their fleas was provided a few years later by American workers.

Derrick's discovery of "Q" fever in Brisbane in 1935 and his subsequent elucidation with collaborators of its natural history opened another new chapter in the history of rickettsial disease. Just at the present time we are waiting for the appearance of an account of this disease as it occurred in the Middle East during the last stages of the war. It is known to have occurred in Iraq, Italy and the Balkans as well as in the western United States. The experimental study of "Q" fever has turned out to be beset with more danger of infection for the workers than any other disease. There have been at least six infections in Australian laboratories, and the last tally I heard from America was over fifty. When the full story is elucidated I think it will be found that "Q" fever is a much more widespread and perhaps more important disease than it appeared when Derrick first investigated it.

Then there are three investigations from the Hall Institute which at a rather lower level have given results that are accepted as changing the epidemiological picture of the disease in question. The first concerned that very trivial complaint herpes of the lips. This is so common that for many years it was regarded simply as a normal symptom of colds or fevers, and like other symptoms one more readily called forth in some people than in others. The work that Williams, Lush and I carried out on herpes in 1937-1938 was based on previous work by others, but I think it is fair to claim that it led to the first clear exposition of the true epidemiology of *herpes simplex*.

The study of simple herpes of the lips is superficially so unlike that of the familiar infectious diseases that I think it is worth recounting in outline. It indicates some of the interesting by-ways into which epidemiological studies may lead.

Without going into detail and without approaching herpes as a problem, but as something whose natural history is known, the story is something like this.

Babies are born free of herpes. If during life they are going to suffer from cold blisters on their lips, they have to be infected by the virus which is responsible for the condition. The virus of herpes is a perfectly typical virus like that of measles or influenza, and provided we use a suitable living culture medium like a chick embryo, it can be grown and studied quite readily. Anyone who has an early herpes blister on his lip, has in that blister some millions of virus particles, so that it is easy to see where infection may come from.

Children usually become infected at the age of one to three years. With only circumstantial evidence to back it, I should say that most often infection comes from the parents, and that the first stages of spoon-feeding are usually responsible. First infection with the virus, particularly in poorly nourished children, may give rise to a fairly severe vesicular stomatitis, that is, a local infection with blisters in the lining of the mouth and on the lips which break down into shallow ulcers. There is often a fever and sometimes signs of irritation in the brain. It is probable that many children become infected with only a trivial blister on the lip or in the mouth.

In any case the child recovers from the infection in seven or ten days and remains apparently well. But the virus has been implanted in the cells of the areas around the mouth and lips where the primary lesions were produced and it persists there apparently for life. For most of the time it multiplies only sufficiently to maintain itself as one skin cell replaces another, but under the stimulus of an attack of malaria, a cold, or perhaps only exposure to wind and sun, some trigger is pulled. Then the virus begins to multiply, destroying some of the cells and producing the characteristic vesicles—and at the same time gaining an opportunity of inducing infection in another individual.

One very interesting observation that contains the seed of a promise that herpes might be rather readily eliminated was made during our investigations. It is simply that while about 95% of public hospital patients, adults and children, are infected with the virus, only about 40% of a group of people from comfortable homes are so infected. Even in such a trivial matter as herpes, poverty and what it implies is a dominant factor in determining the incidence of disease.

Next there was our work on psittacosis—parrot fever. This disease had been known as a rarity since 1880, when the first recorded outbreak occurred in Switzerland. Several people who had partaken of refreshments in the parlour after a funeral became seriously ill, and their illness was ascribed to infection from a sick budgerigar which had its cage in the parlour. From the very first, therefore, our Australian budgerigar had its part in the story of psittacosis.

The disease attracted lay attention only in 1930 when two consignments of South American parrots brought a highly virulent strain of the virus to Europe. Laboratory investigation of this outbreak resulted in the isolation of the virus responsible, but for a few years the disease was considered to be mainly or exclusively of South American origin. In 1935 a cargo of Australian parrots reached England infected with the virus, and it became necessary to examine the situation in Australia. I started the work by purchasing two dozen grass parrots that had recently arrived at a dealer's establishment from the Mallee and was amazed to find that these apparently healthy birds were almost all carriers of the virus. As result of an extensive investigation we were able to say that psittacosis infection is very widespread in wild Australian parrots and cockatoos. In most seasons the infection is latent in character and apparently does not interfere with the health of the birds, but on occasion widespread fatal infections occur in the bush. In 1937 there were deaths of wild parrots in South Australia, Victoria and Tasmania. One could tell a long and possibly interesting story about psittacosis in Australia; but all I want to say here is that this work served to bring a puzzling human disease into relationship with a disease of wild birds, which amongst them is almost as inevitable and harmless as colds are in humans.

The whole story of the relationships between animal diseases and human infections is a fascinating one: bubonic plague is the classical example, but there are a dozen other diseases that provide equally interesting studies.

The third example of an important Australian contribution is the work carried out by army medical officers Bonin, Andrew, Williams, Funder and Fenner partly in the field and partly in the Hall Institute on North Queensland tick typhus. This is a new member of the rickettsial group of diseases obviously related to the tick typhus of India, East Africa and other warm areas, but quite new to medical science in Australia. There was a considerable group of cases amongst soldiers undergoing training in a North Queensland area of partially cleared rain forest during 1944, and it is probable that the infection would be a minor hazard to any settlement or construction work over a considerable region of North Queensland.

The infection is transmitted by the common tick *Ixodes holocyclus* which attaches itself freely to a wide variety of hosts including man. My colleague, Dr. Fenner, has recently completed a study of the common animals of the region which indicates that a number of marsupials and one rodent may be infected with the rickettsia and so serve for its further dissemination amongst the ticks.

This brief outline of recent Australian work in the field of infectious disease will, I think, give some general indication of the type of problem that may be expected to interest a research department of epidemiology. I should like, however, to discuss in a little detail three major groups of problems that today call for solution in this field. It will be obvious that I am in no way suggesting that they will all be tackled in Melbourne—their solution

must be the joint responsibility of workers all over the world. Our own task will be to do what we can on such problems as arise locally in so far as we have personnel and equipment adequate for the purpose. Much of our activity, however, will be related to one or other of the three main themes that I propose to discuss.

The Understanding and Control of Minor Infections.

In a community like our own the major human plagues have ceased to trouble us. Partly by good fortune, partly by ordinary civic common sense, but mainly by the development of the science of public health, we are free of plague, cholera, smallpox, typhus, malaria and yellow fever. Typhoid fever and dysentery appear occasionally, sometimes in an alarming episode, but on the whole they are diseases that have almost disappeared. Diphtheria, whooping cough and infantile paralysis remain important causes of illness and death in children. Diphtheria can be eliminated as soon as we really want to eliminate it. Whooping cough and poliomyelitis both present serious problems and both are being intensively investigated in many overseas centres of research. Active work on whooping cough is going on in the Bacteriology School and at the Commonwealth Serum Laboratories.

These are all serious diseases, but there are a number of less immediately important infections which are nevertheless responsible for much loss of working time and which may indirectly be responsible for more serious illnesses. It is in this group of diseases that I think we may find a fruitful field of study in Melbourne.

I should like to raise a point of general importance here in regard to research within a university department, that is, should research be concerned only with matters of immediate or potential importance to human welfare? There is a current controversy amongst scientists about the social function of science. What is the primary justification of scientific investigation? On the one hand we have the right wing idealist point of view that the function of the scientist is to add his contribution to the coordinated structure of knowledge which has been solidly built up through the centuries—that the acquisition of knowledge established and verified by the ordinary process of scientific activity and criticism is intrinsically valuable. The left wing materialist, especially when he writes in Russian, regards science as an offspring of economic necessity and calls on the scientist to recognize that his work is worth while only when it serves for the satisfaction of definite human needs. To most of us who are working in the medical sciences the controversy seems completely futile. It is so easy in practice to resolve the dilemma.

To take an example, in 1932 I started a series of experiments to exploit the observation then recently made by Goodpasture that viruses could be grown in chick embryos. The work was done simply because the new method offered a way to find out more about the nature of viruses—it was pure academic research. Yet as the methods of working with viruses in chick embryos developed, more and more practical uses were found. During the last two or three years literally millions of eggs have been used for the production of effective vaccines against typhus, yellow fever and influenza. Today there are experimental vaccines grown in chick embryos not only against human diseases like mumps and smallpox, but also against animal diseases like rinderpest of cattle, fowlpox and laryngotracheitis of fowls and encephalitis of horses.

In fact one may say that really effective research in the medical sciences must be done essentially with a view to the extension and coordination of knowledge. Good work can be done without any concern for human application, but effective applied science must have behind it a solid factual and theoretical structure of knowledge. It is one of the joys of work in the medical sciences that there is hardly anywhere a problem in "pure" science whose solution may not provide some new approach to a practical human need—and equally that one cannot approach an "applied" problem like the prevention of influenza or the treatment of cancer without somehow fitting the essentials of the problem into the general structure of knowledge.

The minor diseases that I have in mind are particularly the respiratory infections, colds, influenza and the like, mumps, measles and German measles and herpes. These are all infectious diseases in the ordinary sense. Anyone can recognize that infection passes from one person to another, and the problems they present are fairly clearly defined ones. Their solution is impeded mainly by the difficulty or impossibility of adequate laboratory investigation of the organisms responsible.

The approach to the understanding of the minor infectious diseases seems likely to come from two directions. In both there is the necessity for close observation of the human patient in a way that is impossible in the ordinary course of hospital or general practice. While I was in England I had two interesting opportunities to see these approaches in being. The first is that of the country general practitioner, the second may be called the use of the human guinea-pig.

I hope some of you have read that interesting and charming little book which I have already mentioned called "Epidemiology in Country Practice", by Dr. W. N. Pickles, of Aysgarth, a little village in one of the most beautiful of the Yorkshire dales. A few months ago I had the privilege of spending three days as his guest—a visit which left me with some of the pleasantest memories of my journey. Pickles has for the last fifteen years taken as his hobby the behaviour of infectious disease in his practice. The practice covers five or six villages or small towns placed along the valley of the Ure with a total population of between two and three thousand. It is a wholly agricultural community, relatively prosperous, conservative and very stable. Some of the farms have been in the hands of the same family for two hundred years. It is possible for the doctor to know almost everyone in the area and to have an intimate knowledge of the social activities that are mainly responsible for the spread of infection in the country.

Most of the deductions that can be made from Pickles's data merely confirm the orthodox statements as to the mode of spread, incubation period and so on, of the common infectious diseases. His work on infectious jaundice, however, was important in demonstrating clearly that the standard incubation period was very close to thirty days and that in general it showed the characteristics of a disease spread like measles, by droplet infection. He was also the first in England to describe a country epidemic of the interesting minor disease known as Bornholm disease or devil's grip. This is probably a virus disease which causes an acutely painful spasm of the diaphragm and sometimes of other muscles. It sometimes presents an alarming picture, simulating some catastrophe inside the abdomen or the onset of severe pneumonia, but normally subsides in a day or two.

This study of infectious disease by a general practitioner in a restricted and fairly isolated region can obviously be a fascinating hobby, and it is one that might be more widely cultivated. I have no doubt that sooner or later episodes that, properly studied, will provide valuable new knowledge, will come to the hand of anyone who undertakes it. Especially, might I add, if he realizes when help from the laboratory angle is needed and where facilities for such help can be obtained.

The use of the human volunteer in the study of minor (and sometimes major) infectious disease has been one of the outstanding features of wartime research. In Australia the malaria experimental station at Cairns under Brigadier Fairley did magnificent work, using army volunteers as experimental subjects for assessing the potentialities and limitations of drug prophylaxis of malaria. In America infectious jaundice, atypical pneumonia, influenza and dengue were all extensively studied during the war period by essentially similar methods. In England, volunteer conscientious objectors served as subjects for very effective studies of scabies.

It is not an easy matter to find suitable human guinea-pigs for such work in peace time, but at least one extensive investigation of the sort is being undertaken in England at present. The Medical Research Council has set up a

unit in Salisbury for the study of the common cold. The primary objective is to find means of cultivating or in some way recognizing the presence of the virus or viruses responsible. The unit is housed in an American hospital that was erected and staffed in 1940 by Harvard University. It was first used as a centre for research in epidemiology, and now after a period as a normal American army hospital it has been presented to the British Government and is once again a research organization. The general plan is to obtain volunteers mainly from university students during the vacation periods and to house them in pairs. The two in each unit are given the same inoculum and can go about together, but they are strictly isolated from contact both with the subjects in other units and with the rest of the world.

As far as the actual experiments are concerned, they are of precisely the same general character as one would use in studying a virus disease of mice or guinea-pigs. Whether they will result in any effective method for dealing with the common cold is, I think, more than doubtful, but I feel confident that they will result in valuable clarification of the nature of the virus or viruses involved.

This development of human experimentation as a means of acquiring medical knowledge is characteristic of the times, and it must be recognized that in almost all phases of medicine there are important problems which wholly or in part require experiment on human beings for their elucidation. Even now in Melbourne very few medical students go through their course without serving as the "normal control" for some investigation. Usually this means no more than having a few samples of blood taken or being injected with some "skin test" reagent. I have wondered whether there is not an opportunity here for some benefactor anxious to make a contribution to medical research that would allow the breaking of really new ground. One might picture a large house in the hills or at the seaside that could provide an attractive fortnight's holiday for about a dozen subjects with a small domestic staff and appropriate laboratory accommodation. Such a set-up could be used, not only for work on the minor infectious diseases, but also for the study of normal physiology and biochemistry. If, as one imagines, most of the subjects would be medical or science students, I fancy that the experience of collaborating in such work would probably serve as a potent stimulus to interest in the scientific approach to medicine as well as providing an interesting holiday. I could easily let myself go in building up the picture of such a queer castle in Spain, but I am afraid that no official source of funds would ever sponsor such an undertaking and benefactors with a large country house to give away, and £2,000 to £3,000 a year to support it, are not easily to be found.

Epidemiological Problems Arising from Human Action.

The last twenty-five years have produced more effective means of action against disease, infectious and otherwise, than the whole preceding centuries of recorded time. But the very success of some of these activities has introduced wholly new problems to epidemiology, and I feel certain that new developments in preventive medicine will continue to throw up unexpected repercussions that will need intelligent study if the best use is to be made of the advances in knowledge.

It is a very human quality to accept a large-scale invisible benefit without gratitude, but to object violently to a small amount of positive discomfort or danger that may be associated with it. Preventive inoculation of various sorts has undoubtedly saved hundreds of thousands of lives, but equally certainly it has been responsible for perhaps a few hundred deaths and a lot of discomfort and illness.

During the war period there was one very important example of the potential dangers of large-scale immunization. In 1941-1942 all American troops were immunized against yellow fever by what is one of the most effective types of immunization known. In March or April, 1942, large numbers of cases of jaundice developed in troops who had been inoculated with certain batches of vaccine. All told, something like 80,000 cases were reported. The trouble was traced to what might have seemed the most innocent component of the vaccine. For technical reasons it was necessary to include a protective protein in the vaccine, and as the most harmless protein to inject into human beings, normal human serum was chosen. Unfortunately in some places and at some times there are individuals who are unknowingly infected with the virus of one type of infectious jaundice. Although they have no symptoms the virus is circulating in their blood, and if they become donors of blood for serum production, trouble arises. This virus is a hardy one which survives the various procedures in the preparation of serum for therapeutic use, and for some people it is infectious in very small dosage. It was conclusively proved that this virus, introduced into the vaccine with the human serum, was responsible for the cases of jaundice following yellow fever vaccination.

This same disease has cropped up rather frequently in England during the war when syringes had to be used for many injections, for example, of penicillin or of the arsenical drugs used for treating syphilis, and when war-time exigencies led to laxity in the proper sterilization of the syringes between injections. Tiny amounts of blood from a patient carrying the virus might in this way be transferred to another patient and induce the disease. Blood transfusion or the use of serum in shock is another way in which jaundice of this type has been produced.

Fortunately the virus appears to be rare in Australia and no evidence of jaundice arising from blood or serum transfusions in this country has yet been published. But it is a potetial danger that must be carefully watched for.

The second instance of large-scale epidemiological happenings produced by human action that was designed to prevent disease, concerns the use of sulphonamides in prophylaxis. Everyone, lay as well as medically trained, is aware of the successful use of the "sulpha" drugs against pneumonia, puerperal fever, meningitis and so on. Penicillin has to some extent replaced these drugs, especially for the seriously ill patient, but the sulphonamides, especially sulphadiazine, remain the sheet anchor for routine use. It is only natural that a drug effective against meningitis and streptococcal throat infections should be considered as a means of preventing as well as of treating such diseases. While I was in America in 1943-1944 I heard a great deal about the success that was attending tests in army and navy establishments on such use of sulphadiazine. Cerebro-spinal meningitis is a very important disease of armies, especially when recruits are being assembled and trained. The organism responsible, the meningococcus, is one of those that produces very many more carriers than cases. It is a general rule that only when 50% or more of the personnel in a camp have become carriers of the organism do cases of meningitis begin to appear. If, when the carrier rate begins to rise, all troops are given 1·0 gramme of sulphadiazine for two or three consecutive days, the meningococci disappear from 90% of the carriers and meningitis cases stop appearing. This has been, I think, the universal experience with meningitis, and it was hoped that similar success would be obtained with streptococcal infections such as are responsible for tonsillitis, scarlet fever and rheumatic fever.

Preliminary American work indicated that if the sulphadiazine was given, not for two or three days only, but each day through the winter season, the normal increase in the streptococcal carrier rate did not occur and cases of tonsillitis and rheumatic fever were markedly fewer. In 1944, therefore, a very large section of United States naval training establishments were put on a *régime* of half a gramme of sulphadiazine a day. Some months later, results did not seem to be satisfactory. There were unduly large numbers of streptococcal infections in the area, more in fact than were occurring in camps where sulphadiazine was not being used.

Full investigation showed that two types of streptococci (numbers 17 and 19) were responsible for this increased incidence of scarlet fever, tonsillitis and their complications. These types were resistant to the sulphonamides

and could spread as easily in persons on sulphadiazine as a virulent normal strain will in untreated individuals. There is no reasonable doubt that the appearance of these strains was directly due to the use of the sulphadiazine as a prophylactic. A specially disquieting feature was that persons on sulphadiazine were shown to be more susceptible to these drug-resistant strains than untreated persons were. Fortunately the streptococci were still sensitive to penicillin and no significant loss of life apparently occurred. From the point of view of military effectiveness, however, the episode was most disturbing and will undoubtedly render public health authorities very averse to recommending chemoprophylaxis of this sort on a wide scale.

Perhaps I might digress here to discuss briefly what are the conditions under which drug resistant organisms are likely to arise. The problem is really quite similar to the general evolutionary one of the emergence of new species of animals. The requirements seem to be, first, an opportunity for the appropriate mutation to occur and, second, environmental conditions such as will provide a definite survival advantage for the new form. In practice, this means first that the infection shall be a common type providing very large numbers of microorganisms within which a rare mutation has a chance to arise, and second—and this is the medically important point—that a large proportion of the potential hosts shall be treated with the drug in question. Only under such circumstances has a drug-resistant form sufficient advantage over the normal form to replace it as the dominant type. That is a dogmatic statement that might well need qualification under certain circumstances, but it does provide a useful basis for administrative action.

On this view, chemoprophylaxis should never be applied to a whole community for any prolonged period. It is legitimate to make a short two to three day effort to eliminate meningococci from a camp or institution, and it is equally legitimate to endeavour to protect a small specially vulnerable section of the community, for example, rheumatic children, by prolonged prophylactic administration of an appropriate drug. There are also dangers in the universal use of a single drug for the treatment of patients with an infection like gonorrhœa, in which practically all initial infections are frank symptomatic ones. In fact, sulphonamide-resistant gonorrhœa very rapidly became the dominant form in America, and there are pessimists who consider that penicillin-resistant strains of gonococci will soon become equally evident.

Both the examples I have given will indicate how any major advance of medicine may by its very effectiveness introduce important new epidemiological problems. The uneasy equilibrium between man and his parasites is a complex delicately balanced affair; many of the factors which are involved are probably still unknown to us and effective interference may in the long run produce unfortunate results by disturbing the balance in some unsuspected fashion.

There is one other more direct human interference in the epidemic disease situation which must also unfortunately be considered in the future. Bacteriological warfare was not used in the war, but it is no secret that effective methods for the production of disease in enemy populations were developed. The effect of such a type of warfare would be so unpredictable both epidemiologically and psychologically that no sane nation would ever embark on it. That can hardly be taken as ensuring that it will never be used. Irrespective of whether it is or not, there will always be the necessity of some reserve of trained epidemiologists and public health workers to deal with military problems as long as the possibility of war exists.

Epidemiology as an Aspect of Human Ecology.

The third group of problems which may engage the attention of an epidemiologist today is in a somewhat different category. So far I have spoken about specific practical problems, some of them ever present, some of them arising only by accident, but all capable of direct experimental and field investigation.

What I am now concerned with, however, is the broader aspects of the subject of epidemiology. I know that many scientists regard "broad aspects" as synonymous with "faulty generalizations" which are of no practical significance and which will inevitably be proved wrong by further work. And I must confess that if one wants evidence of the correctness of this objection, one has only to read the discussions on epidemiology in any medical or scientific publication more than seventy or eighty years old. Epidemics were magnificent subjects for speculation, and all sorts of theories were published, all of them wrong. Boyle, who was as wise as anyone in his day, regarded epidemics as being due to vapours of subterranean origin arising "from orpimental and other mischievous fossils".

Despite these object lessons from the past, I still believe strongly that there is a need for, and a possibility of, reaching valid generalizations on epidemiological matters. Since 1935 I have published a good deal on the thesis that the process of infectious disease must be studied essentially as problems of ecology—ecology being the science which is concerned with the study of the interactions of plants and animals (considered either as individuals or as communities) with their environment and particularly with the other living organisms of their environment. Epidemiology which deals with the interaction between man and the microorganisms that parasitize his body is clearly a restricted portion of the science of human ecology. It is probably too complex a subject ever to be susceptible to a rigidly scientific approach. It resembles sociology and meteorology (with both of which sciences it has many intimate links) in presenting situations which, while showing definite similarities to previous situations, are always in some sense unique. And as in the other two sciences, there will always be scope and need for generalization a little beyond what is rigidly demonstrable—and particularly for any generalization which will point out the lines of work which are necessary to confirm or refute it. Equally it must be remembered that since from the point of view of control every epidemic has its unique local features, generalization can never replace the necessity for continuous recording and study of the disease situation within the community.

A few such broad needs for generalization in epidemiology may be mentioned. One is the part played by genetic factors in determining the incidence and character of disease. Some day some enthusiastic epidemiologist will have every pair of identical twins in the country on his card index and under medical observation. Ten years' work on such lines would probably tell us a great deal about the respective roles of nature and nurture.

A second is concerned with the age incidence of infectious disease. Is there any broad principle which will let us understand why the average age of infantile paralysis has steadily increased over the last fifty years? Why meningitis is a disease of infants except when it invades army camps in wartime. Or why psittacosis hardly ever kills persons under forty years of age.

Probably the most important of all the broad epidemiological problems is the part played and to be played by infectious disease in human history. Many writers have incidentally discussed the importance of infectious disease in modifying the course of history. The black death (bubonic plague) had an outstanding importance in the social development of the Middle Ages, and the prosperity and power of the Romans and their successors in Italy seem to have waxed and waned inversely with the intensity of malaria in the country. Zinsser has pointed out how when the Roman Empire was at its zenith there was every opportunity for the transport of infectious disease from Africa or the East to the Mediterranean and Western European countries. Only a modern public health organization could have kept such an empire free from epidemics, and there is sufficient evidence that from the time of the Antonine emperors onward great epidemics played a significant part in the "Decline and Fall".

But all historical writers have tended to stress the significance of the obvious epidemics and to forget a much more important factor—infantile mortality due to infectious disease History is essentially the story of the growth and movement of human populations, and until the middle of the nineteenth century the only check on

population was infantile mortality due sometimes to famine, but predominantly to infectious disease of one sort or another. I think that an excellent case could be made for ascribing the successive waves of barbarians from the steppes and tablelands of Asia and Eastern Europe to the cities and civilizations of the Mediterranean basin, to a single dominant cause—the lower toll of disease in infancy amongst nomads than amongst dwellers in crowded insanitray cities. This thesis of the differential effect of infectious disease in infancy in determining population levels and movements in the past could be developed considerably, but it would always be handicapped by the lack of accurate numerical data.

That difficulty is not now so evident in some parts of the world at least. There is plenty of statistical material to support the contention that, except in countries with high standards of living and of education and with some tradition of individual freedom, human populations increase at a rate corresponding to about three to four fold multiplication of numbers every thirty years, unless checked by infectious disease, famine or war. It should be a very sobering fact that in the last decade the means have been made available to eliminate the major causes of infantile mortality throughout the world. Malaria and the various intestinal infections are the most important of these and both groups of diseases are now preventible. It is interesting to note that the Rockefeller Foundation Report of 1945 presages an attempt to rid Sardinia completely of malaria, and also to know that wartime work has shown that 95% of cholera patients can be saved if penicillin and sulphadiazine are combined with appropriate measures to cope with the dehydration of the tissues.

It becomes a simple matter of arithmetic to realize that if infectious disease amongst unenlightened peoples is to be reduced to Western European levels, then the other two checks, famine and war, must come in its place. Quite seriously, I think that the major political happenings of the next hundred years will be determined by the relative speeds with which, on the one hand, preventible infectious disease is eliminated, and, on the other, knowledge of means of population restriction is made generally available.

One of the major impressions I brought back from the Empire science conferences was the necessity for the full realization by those responsible for national policy of the basic realities of human ecology. In the biological discussions at the conference the central character of the problems of human nutrition was very evident. Agriculture is almost wholly concerned in providing at first or second remove human food. There was much discussion of the nature of soils, of the necessity for soil surveys and of the most efficient utilization of each variety of land, of the choice of crops, of the prevention of plant diseases and so on. But from the human side, there was equally significant discussion of the economic basis of agriculture, of mixed subsistence farming as opposed to a single cash crop, of food habits which often render theoretically perfect diets wholly unacceptable, and of the population pressure which in India and China dominates the whole problem. And as I have indicated, those of us who were concerned with the prevention of disease wondered to what calamity the full application of our science to such countries would lead.

In concluding this address, let me come back to my starting point, the justification for the development of a research department in epidemiology within the University of Melbourne. I hope that I have been able to establish my contention that there is a field for work in such a department that may range from the study of trivial infections to the consideration of major political problems. There is much that I have deliberately omitted, notably, any discussion of the possibility of experimental epidemiological work in the laboratory; but I hope that I have indicated that despite all the work of the great epidemiologists in the past, there is still an inexhaustible field for useful work. In fact, it is of the very nature of ecological problems that they are never more than temporarily solved; in epidemiology as in politics, eternal vigilance is the price of freedom, whether from bureaucratic oppression or from infectious disease.

THE DEVELOPMENT OF CLINICAL PATHOLOGY.[1]

By LUCY M. BRYCE,
Melbourne.

PATHOLOGY, especially perhaps those aspects of this subject which are usually included in the term "clinical pathology", as distinct from morbid anatomy and histology, has often been called the Cinderella among medical specialties. While I certainly do not wish to suggest that those practising other branches of medicine have the failings of the ugly sisters or their attitude towards their Cinderella, I think that if we pathologists accept the status of the latter, it is perhaps comforting and even flattering to reflect upon her modest, but noble, virtues, and her ultimate triumph.

The immediate stimulus which brought about this meeting to consider the inauguration of a Section of Clinical Pathology within the Victorian Branch of the British Medical Association was a suggestion made by Dr. Roy Watson (Honorary Secretary of the Branch) earlier in the year, when representative pathologists met to discuss with Professor Rubbo what should be the future relationship between the work of practising pathologists and that of the University School of Bacteriology and its associated Public Health Laboratory.

The establishment of this section has, however, more than local significance. There has been a world-wide trend during the past few years to discuss and argue about "just what is clinical pathology?", and even if, as often happens, no agreement is reached, these arguments are in themselves a sign of healthy interest in the subject. Other evidence of such interest is provided by the appearance of relevant articles and correspondence in existing journals, the creation in various countries of new journals devoted especially to clinical pathology, the formation of associations of clinical pathologists, and the establishment of post-graduate courses and diplomas. All these activities indicate that although the exact scope of the subject may still be ill-defined, it is emerging as a branch of medical practice, the importance of which is being increasingly recognized.

It is opportune, therefore, to pause and to take stock, as it were, of its present position in our medical scheme, and consider the path along which we should aim to guide its development in the uncertain future.

When the Honorary Secretary asked me if I would be able to give an address on this subject at this meeting, he suggested that it should be along the lines of an article entitled "Clinical Pathology Past and Future" which appeared in *The Lancet* of April 6, 1946. The author of this article is Dr. Robb Smith, who is director of pathology at the Radcliffe Infirmary and Nuffield Reader in Pathology in the University of Oxford. The achievements and status of the author command our respect and the article is a most interesting and thought-provoking one. While certain parts of it are, as would be expected, applicable only to conditions peculiar to England, and while I do not wholly agree with some of the opinions expressed, so much of its subject matter is of general significance that I have taken the liberty of drawing freely upon it as a basis for my remarks tonight.

For the purpose of tracing the development of clinical pathology I therefore propose, in the main, to follow Dr. Robb Smith's example and to review the relationship of this subject to other branches of medicine from the era just prior to World War I to the present time. This period may be considered somewhat arbitrarily in five stages, together with the two interruptions and consequent modification of normal evolution, brought about by World Wars I and II.

The First Stage.

The first stage is represented by the era just prior to World War I. Dr. Robb Smith states that at this time in

[1] Read at the inaugural meeting of the Section of Clinical Pathology of the Victorian Branch of the British Medical Association on August 6, 1946.

England, most hospitals of standing were beginning to appoint pathologists to their staffs. The officers so designated were usually not specifically trained as such, but were most often consultant physicians, who happened to have a liking for laboratory work. Thus, Dr. Robb Smith remarks, began "the symbiosis between consulting medicine and clinical pathology", and I would add, probably also the conception implied in the term "clinical" pathology.

We still have an interesting and by no means valueless legacy from that era in the sturdy little book known affectionately in my student days as "Hutchinson and Rainy" in which there are chapters side by side on such essentially clinical matters as the various aspects of physical examination, and laboratory procedures, some quite intricate, and today most certainly regarded as the province of the clinical pathologist rather than the consulting physician.

After this first of my five stages came the interruption of the war of 1914-1918.

During that war considerable advances were made in laboratory aids to diagnosis, not only in the realm of the clinical pathologist of the day, but more particularly and specifically in bacteriology and biochemistry and in relation to blood transfusion.

The Second Stage.

In the period which I call the second stage, that is, from approximately 1920 to 1930, it therefore came about, as a direct modifying result of these wartime developments, that many of the larger hospitals made provision for application of these advances by the establishment of separate departments of bacteriology and biochemistry, and sometimes of morbid anatomy. But clinical pathology itself had also advanced, and required more time than could be given by a consultant physician who regarded it as something between an interesting side-line and a hobby, or more experience and training than that possessed by a registrar who as an alternative to the appointment of a part-time physician was sometimes allotted to "lab. work", often in conjunction with other duties, for a few months during his tenure of office.

During this stage, therefore, there was a trend towards the appointment of full-time clinical pathologists, at least in the larger or more progressive hospitals. As, however, such hospitals were usually those in which specialist bacteriologists and biochemists were also appointed, to carry out the work in these subjects necessitated by the recent wartime advances, the tendency developed to allot to the clinical pathologist chiefly the routine tests of well-established diagnostic value. This tendency had two outstanding effects on the evolution of clinical pathology, one good and one bad. The good one, as far as clinical pathology was concerned, was that it retained for the clinical pathologist as distinct from other laboratory personnel the closest contact with his clinical colleagues. The bad one was that he often became so over-burdened with routine that it was more difficult for him to keep up with and take advantage of recent advances than it was for his bacteriological or biochemical colleagues. Hence, a suggestion of drudgery came to be connected with the work of the clinical pathologist, in which perhaps was the genesis of our Cinderella.

However, during the same decade, events occurred which fortunately modified the bad effect of this tendency; notable among these events were the discovery of insulin by Banting in 1922, and the introduction of liver treatment in 1926 by Minot and Murphy. The exploitation of these outstanding advances for diagnosis of disease and control of treatment of patients was, because of his established liaison with clinical medicine, regarded as the province of the clinical pathologist. These events, therefore, consolidated the good features of his previous status, and largely did away with the disadvantages. Although laboratory control of insulin therapy has more latterly and perhaps appropriately, in many hospitals, reverted to the biochemist, the new knowledge of hæmatopoietic principles stimulated by the work of Minot, Murphy and Castle opened up a large field in hæmatology, which in its earlier more routine aspects had already formed part of the work of the clinical pathologist and which in continually expanding form has continued as his province to the present day.

The Third Stage.

These important developments, particularly in hæmatology, emphasized the need for special training for medical laboratory work, and the period in which effective action was taken to provide such training may conveniently be called the third stage, and also conveniently coincides approximately with the 1930 to 1940 decade. During this stage outstanding events which took place were: (i) The formation in England of the Association of Clinical Pathologists. (ii) The establishment at the British Post-Graduate Medical School of a pathology department organized on a basis which at the time was a definite but progressive departure from previous orthodox plans. This department was divided into four sections, namely, morbid anatomy and histology, bacteriology, biochemistry and clinical pathology. Each section undertook the routine diagnostic work in its own sphere, but provision was made by adequate staffs for these sections also to undertake appropriate research and to collaborate with the clinical officers. Accommodation was available for a certain number of approved research workers wishing to undertake special investigations under the direction of senior members of the staff, and post-graduate courses, both theoretical and practical, were arranged which provided suitable teaching for those working for the post-graduate diploma of clinical pathology of the University of London.

A pathology department organized along these lines is obviously one of the most satisfactory ways of providing a laboratory service which gives maximum diagnostic aid in relation to individual patients, and at the same time provides excellent facilities for the types of investigation often referred to as clinical research (the only type of research which immediately concerns us in a discussion of clinical pathology) with resultant vitalization of both the laboratory and clinical work of those concerned. It is, however, an ideal which can be attained only in reasonably large and well-equipped teaching hospitals. In other institutions, and in relation to private consultant and general practice, which, after all, are together responsible for the medical care of a large proportion of the population, the role of the clinical pathologist may be more difficult to define. But this very difficulty makes it all the more important to give thought to the subject, and to try to clarify our ideas regarding both the present and the future.

The Fourth Stage.

At the present time, which I regard as the fourth stage in the development of clinical pathology, there is a trend to consider that all diagnostic laboratory procedures should be relegated to large central laboratories not necessarily associated with a hospital. I think most of us would agree that this opinion is valid in respect of investigations carried out for the protection of the community, rather than in the interests of an individual patient. It might reasonably apply also, in the case of procedures which, especially if only infrequently required, necessitated the use of intricate or expensive equipment which it would be uneconomic to the community to provide in more than a few centres, and also in the case of tests requiring very specialized knowledge or experience, such, for example, as the detailed classification of Salmonella organisms.

On the other hand, after many years of experience both of hospital and of other institutional laboratory work, and in the practice of private clinical pathology, I am convinced that as long as private practice exists, there is a very definite need for clinical pathologists, endowed, by virtue of training and experience, with the versatility obtainable only through close contact with both clinical and laboratory aspects of medicine and fitted to deal with patients themselves and not only with a varied assortment of "specimens" sent from near and far. In many cases it is most desirable that pathologists be available to

individual patients, in cooperation with the attendant general practitioner, physician or surgeon, to advise on and to carry out, at least in the initial stages, and at the most appropriate time, the various investigations (often of diverse nature) most likely to yield useful information, and to interpret the results of such tests, on which may depend not only the diagnosis, but also the prognosis and further management of the patient and possibly his contacts. It is no more reasonable to expect that the physician or surgeon should be as conversant with details of technique and knowledge in this specialized and rapidly expanding field than that the clinical pathologist should be able to localize exactly a lesion of the central nervous system or be competent to advise a surgeon on his choice of suture material or incision, or a radiologist on his exposures or interpretation of the shadows on his films. There is sometimes, however, a feeling that practitioners in other fields who would not consider themselves qualified to carry out, say, X-ray work, should still "do" their own pathology, and are perhaps shirking their duty if they do not do so. This perhaps is a lingering result of the early symbiosis between medicine and clinical pathology, but nevertheless it implies a lack of realization of the advances in the latter subject, which make specialized training and experience necessary, not only for the proper performance of pathological investigations and the interpretation of their results, but also in order that pathology may play its true part in improvement in the general standard of medical work, with resultant benefit to the community at large.

Satisfactory liaison of this nature between clinical workers and pathologists can readily be obtained in hospitals in which pathologists form part of the staff, but it is obviously difficult or impossible in other large laboratories dealing with a large number of "impersonal" specimens, in which perhaps only the director and one or two of his immediate subordinates may have the necessary medical experience as well as proficiency in laboratory procedure.

There is also the problem of domiciliary practice. It is not necessary and sometimes not desirable, even if it is possible, as it certainly is not at the present time, for every patient who would benefit by one or more laboratory investigations to be admitted to hospital, and it would probably be very difficult for large hospitals or central laboratories to deal with this problem as readily as can a practising pathologist. In the same way, the latter can most readily and economically supply the necessary pathological service to patients in smaller hospitals without their own laboratories, thus incidentally in the case of pathology, as well as in other specialities, supporting the principle of free choice of consultant.

In Melbourne and Victoria generally there has been and still is a dearth of clinical pathologists available for patients other than those in the larger hospitals. This dearth has been brought about partly, I think, through fear of financial failure due, especially in the past, to competition by the University of Melbourne for examination of specimens for fees which did not even cover the cost of investigations, and partly through lack of facilities for a post-graduate training which would give competence and confidence to start practice. It is surely an uneconomic feature of our system that most medical graduates who have received hospital or institutional laboratory appointments in the past, have had to acquire or be given their specialized training during the first few years of the tenure of these appointments.

The dearth of clinical pathologists and the consequent lack of facilities for prompt and competent investigations have in turn had an adverse effect on the practice of clinical pathologists, since by being forced to make diagnoses and to treat their patients without the desirable investigations, many practitioners in Melbourne are, I think, less "pathology-minded" than are their colleagues in other cities, where clinical pathologists are more numerous.

The question of the additional cost to the patient is often raised, far more so as a rule, I think, in the case of "Cinderella" than, say, of an X-ray examination. But if one takes a broad and long view, the cost is surely offset, certainly in the aggregate, and often in the individual case, by prompt and accurate diagnosis, which may result in the saving of time, and perhaps of expensive and unnecessary medication. (For example, large sums are sometimes spent on expensive liver preparations, when an initial blood examination would have revealed that the much cheaper iron therapy was required, or even that the patient was not anæmic at all.) Further, another result is the help given to the patient in the management of his affairs by an accurate prognosis, as, for example, in the assessment of renal function. I have rarely found that patients for whom only essentially necessary tests have been carefully selected, and to whom the reason for them has been explained, object on the grounds of expense; and for those on whom the financial strain is severe, the pathologist is surely willing to fall in with his colleagues in the matter of reduction or remission of fees.

Actually, too, the dispersal of medical services among relatively small units, in which there are less administrative expenses, such as inevitably pile up in excessively large or centrally controlled organizations, would, I think, if analysis were possible, prove to be more economical to the community at large, whether the cost be borne as a "free service" by the taxpayers in general, or by individuals, who if provident will offset the financial strain of illness by insurance.

At present, therefore, we have, in effect, two types of clinical pathologist. First, there are members of a laboratory team at large hospitals whose sphere of work and relationship with their colleagues is fairly well defined. Secondly, there are those who practise privately or are appointed as sole pathologist at smaller hospitals, whose size and finances do not warrant provision of separate departments of bacteriology, biochemistry and other branches of laboratory work. This second group have rather a dual role. In one sense they are the general practitioners of pathology (if we use this term not in the slightly derogatory implication suggested by Dr. Robb Smith, but rather remind ourselves that sound general practice is regarded as the best foundation for good medical service to the community) in that they should be able to perform or to guide the performance of at least the simpler diagnostic tests in all fields of diagnostic laboratory work, rather than only in the more specialized and restricted sphere of the clinical pathologist who works in association with a team comprising also a morbid anatomist, a bacteriologist and biochemist. Such pathologists are, however, also to be regarded as consultants in that they must be competent to advise their clinical colleagues, if necessary, on the selection and interpretation of laboratory investigations for individual patients.

Having thus rather sketchily surveyed the situation at present, particularly in reference to local conditions, I shall briefly consider the influence of the recent war. Actually it is rather too soon perhaps for us to have a clear perspective on this matter; but tentatively I would express the opinion that it does not seem to have brought about such fundamental changes in our conception of the sphere and role of pathology as a medical specialty as did the first world war. To Australian pathologists, however, it has brought greatly increased knowledge of tropical diseases, and the policy adopted by the army of supplying initial special training for medical pathologists and technical assistants for pathology departments in all the major military medical units has emphasized the value of pathology as an integral part of the medical services.

The Fifth Stage.

I now finally refer to my fifth stage, namely, the future. In view of possible expansion of laboratory services, it is appropriate to consider here the relationship of pathologists and technicians and other laboratory workers. Dr. Robb Smith expresses the view, with which I concur, that a technician should be regarded as a craftsman, and that his training is not designed to fit him for the responsibility of diagnosis. It is, therefore, unfair to him, however good a craftsman he is, to burden him with this responsibility, and if he is not a particularly

good craftsman, I would add, it may be disastrous for the patient. I would also add that any medical graduate undertaking the control of and responsibility for reporting on work done by his technical assistants must be qualified to do so by virtue of personal knowledge and experience of the procedures involved. Only in this way can he hope to assess the accuracy of the work of his assistants, and to maintain the personal responsibility to the patient, which is a fundamental concept of our medical practice. In this connexion, also, it should be recognized that while one pathologist cannot and should not be expected to control directly and to accept responsibility for the work of too large a team of subordinates, on the other hand, cooperation between a pathologist and a chosen team of one or more well-tried assistants is the most productive form of laboratory work. The pathologist is freed from too great a pressure of routine, which might leave him insufficient time to keep abreast of literature, to maintain desirable contact with his colleagues or to concentrate on unusual problems which arise from time to time, while the assistant is not harassed by unfair responsibility, and can carry out expeditiously and without disturbing interruption his technical procedures, and perfect his craftsmanship.

Science graduates are in a different category to craftsman technicians. They are professional colleagues, and in the subjects which they have taken their degrees (for example, chemistry or bacteriology) may have more fundamental knowledge than the medical graduate. They are, therefore, invaluable and independent members of a laboratory team in a large pathology department. I still think, however, that however expedient it may seem, it is unfair to them, although to a lesser extent than in the case of non-graduate technicians, to place on them the responsibility for reports or interpretations which require medical knowledge and experience which has formed no part of their university training.

I consider, therefore, that in guiding the future organization of pathological diagnostic services we must oppose any attempts to staff laboratories by non-medical personnel only, without at least part-time control by a suitably qualified medical pathologist.

We should also resist attempts to divorce the specialty of pathology from other forms of medical practice, for example, by regarding pathology alone among medical specialties, purely as an ancillary service, subject to separate outside administrative control, with no direct responsibility, in cooperation with the attendant practitioners, to the patient.

We should aim, therefore, at the provision of individual personal consultant diagnostic service and responsibility to patients. It is, I think, immaterial and largely dependent on varying circumstances whether the pathologists who are available for such work practise independently or in association with a group of colleagues or by arrangement with hospital authorities, who, if the size of the hospital does not warrant full-time appointments, may employ pathologists part time and make agreement as to right of private practice. The important point is that by one or other of these means adequate pathological aid should be available to all sick persons, whether in hospital or in bed at home or able to visit their medical attendants.

For the economic benefit of the community in general, large central laboratories such as those of university status (or others supported by communal funds) which have the advantages of special equipment, or highly trained workers in specialized fields should encourage pathologists whose facilities are more limited to seek their advice and cooperation, but should not in general undertake diagnostic investigations for individual patients without liaison with such clinical pathologsts.

Post-graduate training, and if possible, suitable diplomas, should be established in order to maintain an adequate standard of pathological work.

Finally, I should like to quote *verbatim* a paragraph of Dr. Robb Smith's article, in which he describes his conception of what should be the attributes of a clinical pathologist:

"The first essential of a clinical pathologist is that he should have a wide knowledge of medicine—not only of laboratory medicine. He need not be (and indeed cannot be, as he will not have the experience) an expert clinical diagnostician in the sense of being skilled at percussion, palpation and auscultation; but, provided with the clinical history and results of examination of a patient, he should have a shrewd idea of the differential diagnosis and of the laboratory methods that may assist the diagnosis or the treatment. He must also be familiar with all the laboratory methods of value in diagnosis, their limitations and uses, and in at least one branch of laboratory methods should be an expert. He should have had a training in all the branches, but can only continue to advance in one main branch. His interest will remain in medicine, not only in the laboratory, but also in the ward and the consulting room [and I would add to Dr. Robb Smith's words—in the home of the sick patient if necessary], and always as a consultant, an advisor, not a clinician."

I would also add that he should recognize his own limitations, and perhaps those of his equipment and facilities, and should not hesitate to admit that certain investigations can be better done by others than by himself.

In conclusion, I should like to thank the Council of the Branch, and particularly Dr. Watson, for their effective interest and sympathy, which have led to the formation of this Section of Clinical Pathology. It is auspicious that it should be inaugurated during the term of office as president of the Branch of our professor of pathology, and finally, I think we may look forward from tonight to an era in which pathologists will, through this section, be able to speak with one voice and to obtain support if need be on matters which affect their status or opportunities and also, through its meetings, to foster friendly cooperation and understanding of each other's special problems and interests, bringing to each the stimulation in work which must enhance the value of pathology as an integral part of medical service to the community.

CERVICAL AND THORACIC INTERVERTEBRAL DISK DISEASE.

By JAMES H. YOUNG, M.D. (Adelaide), M.R.A.C.P., *Perth*.

Cervical Intervertebral Disk Disease.

A DIAGNOSIS of brachial neuritis has never been proved by pathological examination, and the existence of fibrositis as a primary pathological entity is at least open to doubt. It is therefore better to make no diagnosis than to use these terms, for if we continue to be satisfied with such diagnoses, our patients will suffer from lack of scientific investigation and treatment.

In a previous paper[1] I published figures showing that radiological evidence of cervical disk disease could be found in a large percentage of patients complaining of neck pain, of scapular pain and of cervico-brachial pain. Further figures showing the incidence of radiological signs of disk lesions in such patients are given in Table I, which also shows the figures previously published.

A cervical disk lesion has recently been found at operation in one of my patients in whom there were no radiological signs, the affected disk being localized by the tenderness and by the mobility test. We therefore know that cervical disk disease occurs more frequently than the figures in Table I would indicate; but its true incidence is not yet known. It would appear to be a less frequent cause of cervico-brachial pain than lumbar disk disease is of sciatic pain. This is because lesions of the shoulder region are a frequent cause of cervico-brachial pain, whereas there is no comparable structure in the lower limb which commonly causes sciatic pain.

The cervical intervertebral disks are subject to the same three pathological processes as are the lumbar disks—rup-

ture, degeneration and herniation. As in the lumbar region, these conditions overlap, one predisposing to the other.

Degeneration of a Cervical Intervertebral Disk.

Degeneration of a cervical intervertebral disk is a common condition. In the past it has been labelled fibrositis, brachial neuritis and spondylitis.

Radiographic evidence of disk disease may be found in persons who have no past history of stiff neck or brachial neuritis. Cervical disk degeneration may therefore be symptomless.

Abnormal mobility is probably always present between the affected vertebræ in the active stages. This can sometimes be demonstrated radiographically,[1] and has always been present in the few cases in which surgical

TABLE I.
Radiological Evidence of Cervical Disk Disease.

Complaint.	Previously Published.		Present Series.	
	Number of Cases.	Positive X-ray Findings.	Number of Cases.	Positive X-ray Findings.
Neck pain.. ..	19	14	19	12
Scapular pain ..	16	10	14	5
Cervico - brachial pain	84	44	96	48

treatment has been given. When the disk degenerates it becomes thin and there is abnormal mobility between the vertebræ. Nature attempts to compensate for the abnormal mobility by shortening the surrounding ligaments. It is my belief that if the ligamentous shortening keeps pace with the degenerative process, there will be no abnormal mobility and no symptoms. On the other hand, if the ligamentous shortening lags behind the degeneration, the disk will be abnormally mobile and symptoms may then occur.

The intervertebral foramen may be narrowed by thinning of the intervertebral space, and may be further narrowed by backward subluxation of the upper vertebra. The nerve root may therefore be compressed; it is often œdematous, and it may become adherent to the disk. At a later stage osteophytes form at the margins of the vertebral bodies, producing the radiological appearance which we have previously known as spondylitis, and these osteophytes may grow into the intervertebral foramen and irritate the nerve root.

Pain is felt at the back or side of the neck, in the scapular region, or in the distribution of a nerve root (*vide infra*). The pain may be acute, subacute or chronic; it may be constant or intermittent. It is often worse on lifting and carrying. Pain, tingling and numbness are commonly present on waking in the morning, or they may wake the patient at night. They usually disappear soon after the patient gets up. Occasionally the pain may be felt in the pectoral region and be confused with heart disease, or it may radiate from the neck to the back of the eye. I have once seen ciliary injection in association with this eye pain.

The posture of the head is usually normal, but the head may be held flexed to the affected or to the sound side. Sometimes the neck is held rigid and the patient rotates the whole body in looking to one side. In examining these patients it is best to use slightly forced passive movements, and all such movements of the neck tend to be painful. The pain on movement is probably produced by stretching or compression of the disk or the nerve root, or by stretching of adhesions between the disk, the dura and the nerve root. Extension almost always causes pain, generally at the back of the neck at the level of the affected disk, occasionally in the distribution of a nerve root. Forward flexion may cause pain at the back of the neck, over the thoracic segment of the spine, or in the distribution of a nerve root. Lateral flexion may cause pain on the side towards which the patient flexes the neck or on the opposite side, the pain being felt usually in the side of the neck and occasionally in the distribution of a nerve root. Tenderness is present on firm pressure over the affected intervertebral space or just to one side of it, and the pressure may reproduce a root pain or tingling. Occasionally, on pressing over the affected space, one feels a grating sensation, and this is presumably due to movement occurring between the vertebræ, the eroded cartilage plates of which grate on each other. Areas of tenderness and spasm—the so-called fibrositic nodules—can frequently be felt in the muscles of the neck and of the shoulder girdle.

In order to demonstrate tenderness over a cervical intervertebral space, the patient lies prone on the examination couch, a pillow is placed under the chest, the forehead rests on the couch, the shoulders are slightly elevated to relax the trapezii, and the arms lie alongside the body (Figure I). When the patient is in this position the

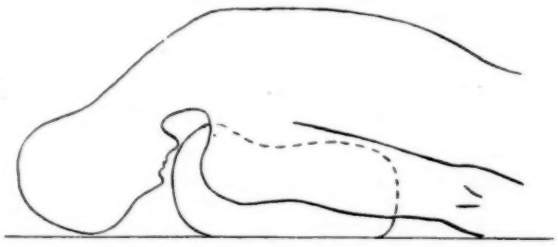

FIGURE I.
Position of the patient for examination of the cervical and upper thoracic spaces and muscles.

intervertebral spaces are opened up and the posterior neck muscles relaxed. It may then be possible to demonstrate localized tenderness over an intervertebral space or just to one side of it, whereas no such localized tenderness could be demonstrated if the patient lay in any other position.

In differential diagnosis lesions of the shoulder region require special mention. Such lesions may cause cervico-brachial pain, and this pain may be accompanied by tingling and numbness in the forearm, in the hand, or in one or more digits. In shoulder lesions the tenderness is over some part of the capsule or over a tendon, and pain is felt on certain movements of the joint; perhaps the range of certain movements is limited.

Pain must be relieved, and for this purpose a mixture containing aspirin (ten grains), phenacetin (five grains) and codeine phosphate (0·25 grain) may be given every four hours.

Rest in the proper posture is important, and the method by which this is obtained will vary according to the acuteness of the symptoms. The neck should be immobilized in the neutral position—that is, neither flexed nor extended. In acute cases, in which the patient complains of neck pain only, immobilization is best obtained by sandbags or by moulding a plaster of Paris slab to fit the back of the head, neck and shoulders, and then causing the patient to lie in this, in the same way as a plaster bed is used for patients suffering from spinal diseases. In cases associated with subacute or chronic neck pain, especially when the patient wakes up with pain, all that may be necessary may be to alter the patient's sleeping habits. If he sleeps on his back with a medium or high pillow, his neck will be flexed forwards. If he sleeps on his side with a high or low pillow, his neck will be flexed laterally. Other patients sleep in the prone position with their necks rotated. Any of these positions may cause the patient to wake with pain. He should therefore be instructed to use a pillow which maintains his neck in the neutral position. Either he should sleep on his back with a low pillow, or on his side with a pillow of medium height. The pillow should be neither too hard nor too

soft, but one which can be moulded to fit snugly around the head and neck, and which will maintain its shape throughout the night and thus immobilize the neck. A well-filled kapok or chaff pillow is satisfactory.

Traction is the most important part of treatment of patients with acute or chronic root pain, and its effect is often dramatic. The patient is put to bed in a Fowler or semi-Fowler position to obtain counter extension, and traction is applied by a Glisson's sling (Figures II and III). A cord is taken over pulleys at the head of the bed and attached to a weight. Six or eight pounds' weight is usually sufficient. A Glisson's sling can be improvised

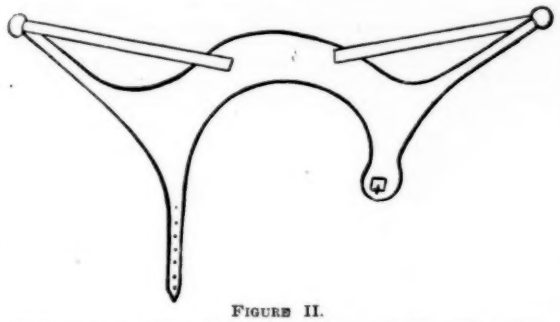

FIGURE II.
Pattern of a Glisson's sling, about one-ninth actual size. It is made of soft leather, but can easily be made of calico in an emergency.

by cutting out a piece of calico to the correct shape and using a coat-hanger for a spreader. Traction is kept up as continuously as possible, but is discontinued for meals, bath and toilet and whenever the patient feels uncomfortable. Some patients can tolerate it almost continuously throughout the twenty-four hours. If traction is going to be of any use, it will have an effect within three or four days, and if it relieves the patient, it should be kept up for ten or twenty days, the duration of the treatment depending upon the original severity of the pain and upon the rapidity of relief. If it is inconvenient for the patient to go to bed for this length of time, traction at night time only is sometimes successful, and this can be carried out in the patient's own home. It is interesting to speculate upon how traction acts. That it opens up the intervertebral foramina and relieves pressure on the nerve root seems obvious. If gross thinning of a disk and lipping of the posterior borders of the vertebral bodies are present, it is not so obvious why the pain does not always recur as soon as traction is stopped. One can only suggest that traction has relieved pressure on an œdematous nerve root, that the relief of pressure has allowed the œdema to subside, and that when traction has been stopped pressure is no longer exerted on a nerve root of normal size. Œdematous nerve roots have been observed at operation.

The injection of local anæsthetic agents has had great vogue in the treatment of "fibrositis" and "brachial neuritis" in recent years. In the past I have had occasional good results with this form of treatment—but they have been only occasional. It has always seemed to me that cures by a series of such injections have resulted in spite of the treatment rather than because of it. I have previously stated that local anæsthetic agents should not be injected into the sacrospinalis of patients suffering from low back pain, because this predisposes the patient to herniation of a disk.[2] In the cervical region, however, the possibility of herniation is remote—first, because the cervical disk is small and degenerates quickly, almost before it gets an opportunity to herniate, and secondly, because the opposing surfaces of the vertebræ are more cup-shaped than in the lumbar region and tend to hold the disk in place. Therefore there is less contraindication to the injection of local anæsthetic agents into the neck muscles. Sometimes I inject the muscles alongside the affected disk to relax muscular spasm and so to help relieve pressure on a nerve root and to make traction more effective. Occasionally injection alongside an affected disk gives immediate relief; but I have yet to convince myself that injection of the so-called nodules around the shoulder girdle is of any value. It is also rather difficult to see how injection of these "nodules" can be of more than temporary value if, as seems likely, they are due to irritation of motor fibres in the nerve roots.[3]

Such irritation apparently leads to areas of spasm in muscle. Metabolites probably accumulate in these areas, and one such metabolite is Lewis's pain-producing factor.[4] Here, then, is a reason why painful areas may occur in muscle in disk disease. Heat, massage and exercise all increase the blood supply of muscle and help to disperse metabolites. They possibly relieve the pain by dispersing the pain-producing factor.

Heat is of value for patients with acute pain. In cervical disk disease I find little difference in practice between the effect of infra-red rays, of short-wave therapy or of a hot-water bag, and the last is cheap and easily

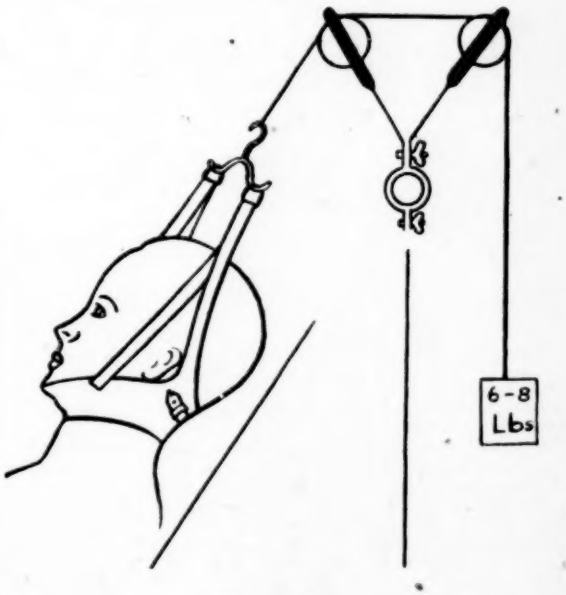

FIGURE III.
The Glisson's sling in use.

obtainable; but I do think it is important that the heat should be brought to the patient. If the patient has to be taken to the heat—for example, to the physical therapist's rooms for short-wave therapy—then the most important principle of treatment (rest) is not being observed. A hot-water bag can be applied outside a plaster of Paris slab, or it can be placed behind the neck of a patient who is receiving treatment by traction. Heat is also of value as a preliminary to massage for patients with chronic pain.

Exposure to cold and to draughts undoubtedly aggravates the symptoms and at times seems to precipitate an attack of pain. Cold and draughts should therefore be avoided, and the wearing of scarves is useful for this purpose.

I do not use massage in acute cases, as I think that adequate rest, traction and heat are more important. Massage I find of most value for patients with chronic neck and scapular pain. I have noticed that massage of the kneading type is the most effective to employ in the scapular region; but in the case of the neck only light massage should be used, as heavy massage may damage the disk and aggravate the symptoms.

I do not find massage of any value for radicular phenomena. Some of my patients with radicular involvement used to be treated by traction in a hospital which is near the masseur's rooms, and they used to go to the masseur for the application of heat and massage every day. Others were treated in hospitals three miles away. These latter received traction only, and as far as the radicular phenomena were concerned, the results were just as good. Sometimes the radicular phenomena are cleared up by traction; but it is necessary to follow traction with massage to relieve the neck and scapular pain.

Exercises will aggravate the pain in the acute stage. In the chronic stages they improve the patient's condition. Neck exercises (flexion, extension, lateral flexion, rotation and approximation of the chin to the shoulder) must not be forced, or the disk may be damaged. Shoulder-girdle exercises (shrugging, circular shrugging, and approximation of the scapulæ) can be used without this fear.

In those cases of root pain in which conservative treatment has failed, the nerve root can be uncapped surgically, and in the few cases in which this has been necessary, the results have been encouraging. The affected disk is localized by the tenderness, by the radiographic signs, and by the mobility test at operation.

Herniation of a Cervical Intervertebral Disk.

Herniation is much less common than degeneration of a cervical disk. Degeneration occurs more quickly in the small cervical disk than in the large lumbar disk, which degenerates slowly and therefore has more opportunity to herniate. The cervical disk usually degenerates before it has a chance to herniate, and the opposing surfaces of the cervical vertebræ are more cup-shaped than those of the lumbar region and they tend to hold the cervical disk in place.

Pain is felt in the neck, or in the scapular or pectoral regions, or in the distribution of a nerve root (*vide infra*). It is acute, constant and worse on movement and on coughing. I think that it is possible to have a small herniation causing pain in the neck only; but if the herniation is of any size, radicular symptoms will be present and possibly evidence of spinal cord compression.

The head is held flexed to the sound side. Extension and lateral flexion to the affected side compress the protruded disk. These movements are therefore painful and limited, and they may cause pain in the distribution of a nerve root. Forward flexion stretches the *dura mater* or a nerve root over the protruded disk. Forward flexion is therefore painful and limited; the pain may radiate down the thoracic segment of the spine or it may be felt in the distribution of a nerve root. Lateral flexion to the sound side is painless or much less painful than lateral flexion to the affected side. The former movement relieves any pressure on the protruded disk, while the latter aggravates it. Tenderness is present over the affected intervertebral space, and pressure here may reproduce root pain or tingling.

Identical signs may occur in degeneration of a cervical disk if one vertebra suddenly subluxates on the other. Both herniation of a cervical disk and subluxation of a cervical vertebra may respond to treatment by traction, so that the final diagnosis may be made only at operation.

Before I knew anything about cervical disk disease I used to carry out manipulation in cases like these, sometimes producing relief. Now that I know what the pathology is and what damage may be done by manipulation, I prefer traction with a Glisson's sling. The pain may subside suddenly during traction or during some movement, the patient noticing a click. If relief is obtained with traction, the treatment is then that of a degenerated disk. Occasionally I have used traction combined with flexion to the sound side under anæsthesia and have obtained immediate relief. In one case this was carried out on three occasions, and each time the vertebra could be felt and heard to slip into place with a crunch. (I do not mean the clicks that one heard with the old type of forcible manipulation. These, I think, are merely vacuum clicks and similar to those which many people can produce in their finger joints by traction.) Later this patient's neck was immobilized in plaster of Paris.

If conservative treatment fails, and this is seldom, surgical treatment will give relief.

Rupture of a Cervical Intervertebral Disk.

When one studies the clinical histories of patients with degeneration of a cervical disk, one sometimes notes that the onset followed trauma, and it would then appear that rupture of the disk was the initial pathological lesion and that degeneration followed. In other cases trauma precipitates symptoms in a disk which, radiologically, is already the site of a degenerative process.

It is probable that many stiff necks and cricks in the neck are small ruptures of a cervical disk. That this is so is indicated (i) by the radiological findings both at the time of the attack and years later, and (ii) by the occasional occurrence of radicular phenomena; for example, if questioned the patient may admit the presence of slight pain or tingling in one or more digits which he may have considered unimportant and not worth mentioning.

There may be a history of injury, but in many cases the trauma may not be obvious—for example, onset of pain while the patient was turning the head suddenly to one side. The patient complains of pain or stiffness which is constant, worse on movement, and felt in the sites mentioned under the previous headings. The head is held flexed to the affected side. Flexion to the affected side is painless or much less painful than flexion to the sound side, which is the most painful movement. Tenderness is present over an intervertebral space or just to one side of it.

I believe that in such cases as these the symptoms are due to small tears in a disk, and that stretching of this tear is painful—hence the signs I have described. In the milder cases the symptoms usually subside gradually in a few days. The treatment is to relieve pain and perhaps to inject a local anæsthetic agent into the neck muscles alongside the tender space or to apply heat. The more severe ruptures are probably always followed by degeneration of the disk, and the treatment is that of the latter condition.

Involvement of a Nerve Root.

A nerve root may be involved in any of the conditions previously described, and if so the following symptoms may be present: (i) pain in the distribution of the nerve root, not necessarily in the whole root area, but perhaps only in part of it; (ii) sensory phenomena—tingling, numbness, diminution of pain sense and less often of touch sense—usually in the lower part of the root area; (iii) muscular weakness and fibrillation; (iv) diminution in or loss of reflexes. These phenomena may occur singly or in any combination.

The radicular syndromes have been described previously,[1] and as a result of further experience, slight corrections are necessary in the descriptions of the fifth and sixth cervical syndromes. Figure IV is a corrected chart of the dermatomes in the upper limb. There are variations in the segmental supply of the muscles and skin; a variation of one digit in either direction is common, and probably depends upon whether the brachial plexus is prefixed or postfixed. These variations will not be mentioned in the descriptions of the radicular syndromes which follow.

There are no disks between the occiput, the atlas and the axis. Root pains involving the first and second cervical nerves therefore do not occur as a result of disk disease. I have seen one patient with third cervical root pain,[2] but none with involvement of the fourth cervical root.

In the fifth cervical syndrome, pain radiates from the neck to the shoulder and to the antero-lateral aspect of the arm. Sensory changes may occur in the antero-lateral aspect of the arm. Weakness of the deltoid and a diminished or absent deltoid reflex may be features.

In the sixth cervical syndrome, pain radiates via the outer aspect of the arm to the radial part of the forearm, the thumb and the index finger. Sensory changes occur especially over the lower half of the radius and in the

thumb and index finger. Typically, weakness of the biceps and diminution of the biceps and supinator jerks may be noticed.

In the seventh cervical syndrome, pain radiates via the postero-lateral aspect of the arm and the dorsal aspect of the forearm to the index and middle fingers. Sensory changes occur especially in the index and middle fingers. Typically, weakness of extension of the elbow, wrist and fingers and diminution of the triceps jerk are present.

In the eighth cervical syndrome, pain radiates via the postero-medial aspect of the arm and forearm to the ring finger. Sensory changes occur especially in the ring finger. Weakness of flexion of the thumb and fingers may be observed.

In the first thoracic syndrome,[1] pain radiates via the inner aspect of the arm and forearm to the little finger and perhaps also to the first intercostal space. Sensory changes occur in the little finger, in the ulnar side of the hand and forearm, and perhaps in the lower part of the inner side of the arm. There may be wasting and weakness of the small muscles of the hand and of the *flexor carpi ulnaris*. Horner's syndrome may be present and Mayer's thumb reflex may be absent.

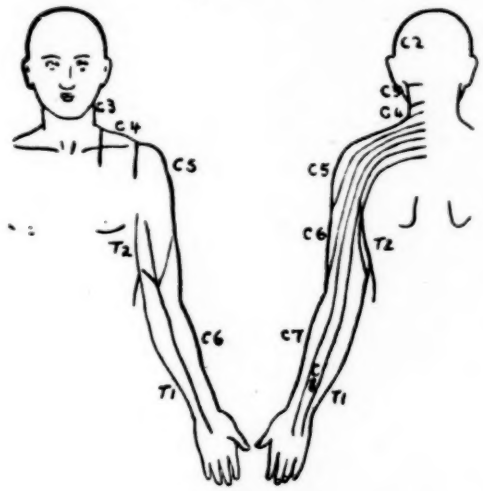

FIGURE IV.

The cervical and upper thoracic dermatomes. This chart is based upon a study of the clinical material mentioned in this and in a previous[(1)] paper, upon cases of *herpes zoster* affecting the third, fourth and sixth dermatomes, and upon a case of scleroderma affecting the sixth dermatome.

With regard to the second thoracic syndrome, I have seen one patient with second thoracic root pain. Pain radiated from the upper thoracic region of the back to the axilla and the inner aspect of the arm. There were sensory changes in the inner aspect of the arm and confirmatory radiological signs.

Radiological Signs.

The cervical disks are usually all equally thick except the seventh disk, which is about two-thirds the thickness of the others, the thickness being measured anteriorly (not posteriorly, as in the lumbar region). The first thoracic disk is about half as thick as the seventh cervical disk. In the presence of a cervical rib the seventh cervical disk is thinner than usual, because functionally it is a first thoracic disk. This is exactly comparable with the physiological thinning of the fifth lumbar disk seen in the presence of a sacralized transverse process.

[1] The first and second thoracic syndromes are considered here for convenience, because of the similarity of the symptoms to those of the lower cervical syndromes.

The radiographic signs of cervical disk disease have been described previously.[(1)] They are flexion deformities, thinning of a disk, subluxation of one vertebra on the next one lower, and eventually lipping of the adjacent vertebral bodies. Double and treble disk lesions are not uncommon. Contrast myelography is unnecessary.

We now know from operative proof that cervical disk disease may occur without X-ray signs. Radiological evidence of disk disease is less often found in patients with eighth cervical or first thoracic root pains than in those with fifth, sixth or seventh cervical root pains.[(1)] This, of course, is only to be expected, as the seventh cervical and first thoracic disks are thinner and less mobile than the other cervical disks; thinning is therefore less obvious and flexion deformities cannot be demonstrated. Occasionally it is obvious clinically that the X-ray film reveals an old healed lesion while the offending disk shows no radiographic evidence of its presence. From the diagnostic point of view, therefore, more notice must be taken of the clinical signs than of the radiograph.

Thoracic Intervertebral Disk Disease.

Pain arising from disease of the thoracic portion of the spine is less common than pain due to disease of the cervical and lumbar regions, and thoracic backache is often difficult to explain unless one is satisfied with a diagnosis of fibrositis or neurosis. Visceral disease, of course, must be excluded.

In the past two years I have examined 66 patients with thoracic backache, who presented no obvious evidence of visceral disease and no obvious neurosis. These cases are classified in Table II. Cases of first and second thoracic disk lesions are clinically so similar to cases of cervical disk lesions that they have not been included in this table. It will be noted that lesions of the other thoracic disks are not rare.

TABLE II.

Causes of Somatic Thoracic Backache in 66 Cases.

Type of Lesion.		Number of Cases.
Disk disease:		
Confirmed radiologically	9	
Proven at operation	4	
Diagnosis clinically certain	10	23
Ankylosing spondylitis		5
Kümmell's disease		5
Adolescent kyphosis (vertebral epiphysitis)		1
Senile kyphosis		3
Costo-vertebral joint injury		1
Costo-transverse arthritis		2
Contusion		3
Unclassified		23
Total		66

The distribution of the confirmed disk lesions is shown in Table III. The high proportion of lesions of the eleventh thoracic disk—that is, at the junction of the fixed thoracic and the movable lumbar portions of the spine—is interesting. In my experience lesions of the eleventh thoracic disk are more common than lesions of the twelfth thoracic and first and second lumbar disks.

As in the cervical region, herniation is uncommon in comparison with degeneration. Rupture almost certainly occurs, as is evidenced from case histories.

The symptoms and signs are similar to those of disk disease elsewhere—that is, one or more of the following is present: local pain, either vertebral or paravertebral, root pain, pain on movement of the spine, tenderness over the affected intervertebral space, neurological signs, and radiological signs.

In thoracic intervertebral disk disease the pain is sometimes aggravated by movements of the neck (possibly from dural stretching). It is therefore easy to confuse a lesion of an upper thoracic disk causing pain in the interscapular region with a lesion of a cervical disk causing

scapular pain. The differentiation of the two conditions depends upon the site of the tenderness.

The upper thoracic radicular syndromes (other than the first and second, which have already been considered) are characterized by pain radiating to an intercostal space. The pain may not necessarily be a girdle or half-girdle pain. Radicular pain may affect only part of the distribution of a root, and thoracic root pain may therefore present itself as pain and tenderness in an intercostal space without any vertebral pain and the pain may be worse when the patient coughs. When such pains are radicular in origin, I have usually found that tenderness is present over the

TABLE III.

Distribution of the Lesion in 13 Cases of Thoracic Intervertebral Disk Disease Confirmed Radiologically or Surgically.

Affected Disk.	Number of Cases.
III	1
VII	1
X	2
XI	8
XI and XII	1

corresponding interspinous ligament or just to the affected side of this ligament. In the past such pains have been called pleurodynia, intercostal neuralgia, intercostal neuritis and intercostal fibrositis; but I doubt if any of these conditions exist except as names. The senses of touch and of pain may be altered in the affected segment.

In the lower thoracic radicular syndromes pain radiates to the abdomen and groin. Disease of the abdominal viscera and especially kidney disease may be simulated. There may be sensory changes in the affected segment, and the superficial abdominal reflex may not be obtained from this segment.

The treatment of thoracic disk disease is to relieve pain and avoid strain. Fortunately the thoracic segment of the spine splints itself, and this aids recovery. A Berlei-Camp corset, number 207, is useful in women and a spinal brace is occasionally necessary. Four of my patients have been treated surgically by Dr. F. J. Clark—one had a degenerated third disk, two had degenerated tenth disks, and one other had a herniated eleventh disk; in all cases the mobility test was found reliable. Two of the patients with degenerated disks were operated on some months ago. The nerve roots were uncapped because of intractable, radicular pain and the results were excellent. The other two patients have been operated on too recently for the results to be assessed.

Summary.

Neck pain, scapular pain and cervico-brachial pain are frequently due to disease of a cervical intervertebral disk.

The cervical intervertebral disks are commonly the site of degenerative processes. Herniation is rare. Rupture is probably not uncommon.

Rupture and degeneration may occur with or without root pain or neurological signs. Herniation may possibly occur without radicular involvement, but if the herniation is of any size there will be evidence of nerve root or spinal cord compression.

Cervical intervertebral disk disease has been proved to occur in the absence of radiological signs.

A corrected dermatome chart of the upper limb has been drawn.

The treatment of cervical disk disease has been described. It will usually give relief.

The thoracic intervertebral disks are subject to degenerative processes, to herniation and possibly also to rupture. The clinical features and treatment have been discussed.

Acknowledgement.

I am indebted to Dr. M. A. Radcliffe-Taylor for much helpful criticism in the preparation of this paper.

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EPIDEMIC KERATOCONJUNCTIVITIS IN AUSTRALIAN TROOPS: A REPORT ON FIFTY-SIX CASES IN NORTHERN QUEENSLAND.

By JOHN HERCUS,

Major, Australian Army Medical Corps; Ophthalmologist at an Australian General Hospital.

WHILE epidemic keratoconjunctivitis has assumed considerable clinical and economic significance in many countries, Australia would seem to have been more fortunate on the whole. This report covers a series of 56 cases found among troops on the Queensland Tablelands, a mild epidemic in the late summer of 1944-1945. Compared with the astronomic numbers of cases occurring in India, Malaya, Hawaii and some United States seaports, ours is an insignificantly minor occurrence; but it is considered that the fact that it did occur at all in this country warrants its recording.

In ordinary civilian practice it has always been possible to meet sporadic cases of superficial punctate keratitis, an intractable and rather multiform disease that will try the patience of both doctor and sufferer. I cannot say for certain how many such cases there are in this present series, but the more recent name of keratoconjunctivitis is here reserved for the acute epidemic form that makes up the bulk of the cases.

The patients were drawn from the whole of the tablelands area and comprise mainly troops of the Sixth, Seventh and Ninth Divisions, together with a considerable number of ordnance, transport, supply and associated base units. The approximate number of personnel in the area during the period under review was given to me by the Deputy Assistant Director of Supply and Transport, and will be seen from the graph in Figure I to range from about 50,000 to 70,000. A considerable troop movement was of course in progress all the time, with reinforcements and replacements and large-scale beach-landing exercises on the coast. This was of the order of a brigade at a time. And finally there was the actual divisional movement to and from combat areas.

Most of the men had been to New Guinea and had a high rate of malarial infection; but so far as I could determine the cases of keratoconjunctivitis were drawn just as much from the wholly fit as from the less healthy, and indeed it may be taken that we are considering the incidence of the condition in healthy young men.

My attention was first drawn to the condition when towards the end of 1944 I began to notice that rather more cases were occurring than one would expect from previous experience. As has been suggested, occasional cases are always to be met; but these were becoming more than just occasional. All patients were admitted to hospital through other medical units and were seldom examined before the fourth or fifth day. It is certain that many of the patients with the condition in a milder form were treated and cured in the field ambulances and casualty clearing stations in the area, and those who were transferred to the general hospital were those who had the more acute or resistant forms of the disorder. It is, of course, not a custom in the army for ophthalmic conditions to be treated by other than an ophthalmologist; but men with the minor injuries and affections which are so common may frequently be held and cured.

The hospital was busy at the time, with an admission rate of something around and over 2,500 a month. The

admissions to the eye ward are shown graphically in Figure II, and in addition I was seeing nearly 500 men per month in consultation. It should be explained that in an army hospital all records are returned to the records office when the patient is discharged, and it was not until the later months that I began to keep copies of the records with more detailed accounts of the in-patients. These earlier records I had to recover from the ward report book, which was kept by the sister in charge of the ward. Here I was fortunate, in that for the period involved the sister was reliable and well experienced in eye work; but my good fortune did not extend to her writing, which was almost hopelessly illegible. These factors are mentioned in order to explain why certain findings that may be expected, such as age incidence, relation to total or oversea service *et cetera*, are not included.

Clinical Findings.

The typical clinical picture is impossible to give, as the disease is so notably variable in its effects; but the one constant feature I observed was that the severity of the symptoms was much less than the objective findings would suggest. Some red, angry, weeping eyes caused little suffering to the patient, merely bringing the complaint that the eye felt "a bit gritty and watery" at times.

The Cornea.

The diagnostic factor that I made the *sine qua non* was the presence of corneal lesions. We had no slit-lamp microscope at the hospital, and examination was made with focal illumination and loupe only; but I do not think there was any material loss in the findings on this account. Observers in other countries sometimes include cases in which the cornea is clear, but I did not follow them in this. Such cases I wrote up as of conjunctivitis and/or blepharitis only. The corneal lesions were more common peripherally and included any or all layers as far as Descemet's membrane. Some were strictly superficial, with the formation of small vesicles, usually ten to twenty in number, and as a rule about a quarter of these would stain with fluorescein at any one time. The vesicles were all small and closely resembled those sometimes seen in *herpes simplex corneæ*. In the deeper layers were found small, discrete, greyish infiltrates with somewhat indefinite edges. Occasionally these were confluent and in one case only was the corneal appearance almost indistingiushable from a diskiform keratitis. Some degree of ciliary injection was the rule, but corneal vascularization was noted in a few cases only, merely to the extent of some capillary loops at the margin. Here no doubt a slit-lamp microscope would have added to the knowledge.

The Conjunctiva.

Mucopurulent conjunctivitis was commonly present, but the secretion was thin and stringy and much diluted with the rather copious tears. The upper lid and upper bulbar conjunctiva were notably spared, but the inner surface of the lower lid was thick and velvety in appearance.

The Eyelids.

Blepharitis when present proved to be the most difficult feature. In some cases the lids were grossly thickened and tender, especially the lower lids, which in a few cases assumed a pustular condition with the tendency to ulcerate. Fortunately these were few.

Systemic and Lymphatic Reactions.

In about half the cases the preauricular gland on the affected side was swollen and more or less tender, and in three cases the submandibular group was just affected. In no case did any rise in temperature occur, and only two patients complained of any initial malaise; but as both of these were previously malarial subjects they were likely to have been in the ranks of those who suffered subclinical malarial attacks, and whose name was legion.

Symptoms.

Symptoms included moderate photophobia, considerable lachrymation and partial loss of vision. Many men said that for the first day or two they had reported a gritty, stinging feeling in the eye, but that this had diminished considerably even before they reached the hospital. Indeed, a few were almost resentful of being admitted with the possibility of missing a draft, contending that it was feeling better and that was all that mattered.

In six cases the condition was bilateral and in only one were the two eyes affected simultaneously. In all the other five the clinical picture was milder in the second eye involved.

Pathology.

As may be imagined from the admission rate of the hospital, and a bed capacity of well over fifteen hundred, the pathology department was working at top pressure; but our pathologist was most helpful and cooperative in investigating these cases for me, and his reports may be summarized as follows.

1. In stained direct smears of the lower conjunctival sac and lower lid were found a moderate number of polymorphonuclear leucocytes and a few organisms, some intracellular. Large mononuclear cells were fairly plentiful in a lid scraping, but on no occasion were any inclusion bodies discovered.

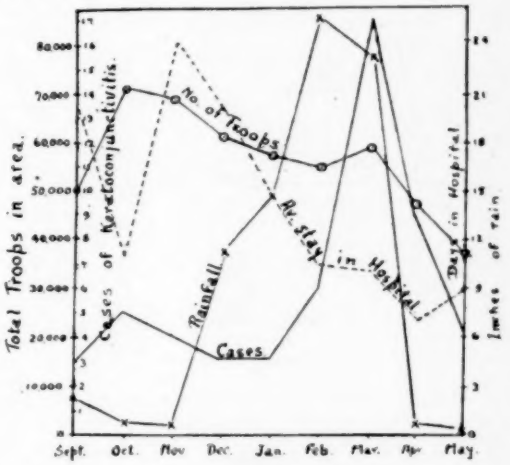

FIGURE I.

2. Attempts at culture were of no assistance, as in several cases no growth was obtained and in others a mixed culture of organisms resulted. In three cases the predominating organism was of some interest in that it had the morphological characteristics of a Koch-Weeks bacillus.

3. The virus source of the disease, now known to exist, was not reproduced or grown. Intracerebral inoculation of mice was of no help; those that died were found on section to have cerebral abscesses from pyogenic contamination, and those that lived were of course equally disappointing. Several attempts were made to grow the virus on the yolk-sac or chorio-allantoic membrane of incubating eggs; but here, too, success did not come our way.

The pathologist was nearly as disappointed with the culture results as I was, for it is always thought that the condition is under better control if there is something to show in a test-tube or under a microscope. We felt that, given more time to spare for the attempts, and with better equipment (especially in the nature of suitable filters for separating the bacteria from the virus), we might have had better luck. Further, it was not often we had a patient admitted to hospital without any previous treatment, and the temptation to hold a patient without treatment while we carried out investigations was one that had to be resisted—to have the men well and back with their units as soon as possible was the only reasonable procedure.

Treatment.

In most cases intensive treatment effected gratifying results. The system finally adopted, and the one applying to most of the cases, was as follows. On the patient's admission to hospital, and on each of the following two days, the lower lids were painted with silver nitrate, after anæsthetization with "Decicain". Penicillin had then only just become available to any extent, and drops containing 500 units per millilitre were instilled every hour while the patient was awake. If the blepharitis was at all pronounced, the lid margins and skin edges were painted with 2% gentian violet solution twice a day for some three days. Finally, atropine sulphate drops (1%) were instilled twice a day as a routine measure. The eye was covered. In some of the earlier cases "Soluseptasine" drops (20%) were instilled every four hours for up to three days; but with the possibility of an ulcerating blepharitis developing as part of the disease, I was not happy about the chance of a local sensitivity making for more trouble still. "Albucid" was not available for most of this time and was not used in any of the cases.

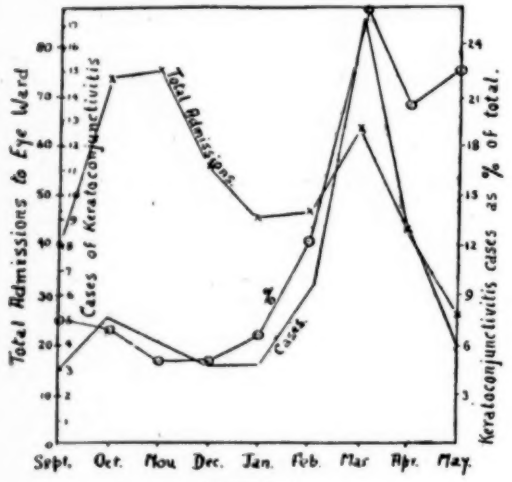
Total Admissions to Eye Ward
Cases of Keratoconjunctivitis
Total Admissions
Cases
Keratoconjunctivitis cases as % of total.
Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May.

FIGURE II.

The Course of the Disease.

The response to treatment of the truly epidemic forms was dramatic. Within twenty-four hours the discharge had disappeared. By the end of three or four days the cornea was beginning to clear and was no longer staining, and the ciliary injection was subsiding. At this stage the atropine treatment was stopped and dark glasses were substituted for the cover. After six or seven days the eye was nearly white, and by the ninth or tenth day the patient was able to leave hospital to rejoin his unit. In fact, I found this condition better to treat than ordinary uncomplicated conjunctivitis. In a few cases there were some residual corneal opacities, especially in those in which the corneal infiltrates had become confluent; but vision was not much reduced. I arranged for these men when possible to report back later, and found that some of the deeper lesions took about one month to resolve. The one exception was the man whose condition resembled diskiform keratitis; his vision was reduced to $^{6}/_{18}$.

Among the earlier sporadic cases eight of the patients were considered as being unlikely to regain class A status and were transferred south. Two of these were so treated on account of a preexisting chronic intractable blepharitis; I did not think it was part of the disease *per se*, but believed that it would render the men concerned unfit for class A service in any case. The other six cases were of the non-epidemic type and the men were disposed of in the same way, since it was my opinion that recurrences for some months at least were almost certain. Indeed, my own view, and one I have found is shared by those army ophthalmologists to whom I have spoken, is that men with these chronic forms of superficial punctate keratitis are best reclassified as class D—that is, unfit. On these last-mentioned cases I had to make a decision reasonably quickly, as we were too pressed for beds to be able to hold a patient merely in the hope that he might prove an exception and recover finally and fully in a short time. From the graph in Figure I it will be seen that the longer stay in hospital was recorded early in the period reviewed. It was in these earlier months that the non-epidemic forms occurred.

Epidemiology.

A few factors of possible epidemiological significance were noted.

Firstly, there was no localized outbreak in any one unit, though I saw two officers from the same mess whom I decided had probably had a mild attack, but who were treated in their regimental aid post and are not included in this series. The troops were located over a wide area, and patients were admitted to hospital from all parts thereof.

Secondly, it was noticed that the incidence seemed related to the rainfall, which here is seasonal. Whether this is purely coincidental or not I cannot say, or whether the relationship should be to temperature or to humidity or to both is not clear. The rainfall figures shown in Figure I are those recorded at Atherton, and are a fair average for the tablelands, so I was informed. The departure of the Seventh Division, the arrival of the cooler dry autumn weather, and the closing of our hospital all occurred within a short time, so that a seasonal variation cannot be claimed.

Finally, in the course of my duty I was called upon to see and treat a number of civilian patients; but none suffering from keratoconjunctivitis was among these. I became fairly well acquainted with the men in practice up there, but they did not know of the disease at all from their own experience.

The possibility of a traumatic basis must be considered. The division troops in particular were liable to minor injury during training and exercises, and again, their use of mite and mosquito repellent lotions may have been a factor. The upper lids are a common site for mosquito bites when the eyes are closed, and instructions were given that the men were to be sure to apply the repellent there. Minor burns of the eyes from this cause were common and caused little trouble. But I had some cases in which the repellent had been introduced into the eyes by mistake and the corneal epithelium had been completely desquamated. I wondered whether the minor chemical irritation from careless application had caused enough damage to allow the entry of the organism where an intact epithelium would have proved resistant. In certain parts of the United States, where this disease is more prevalent, those affected are covered by workers' compensation insurance, partly because of this possible traumatic basis.

Conclusions.

1. A report is made on 56 cases of keratoconjunctivitis among Australian troops on the Queensland Tablelands, the condition reaching mild epidemic proportions in the late summer of 1944-1945.

2. A system of treatment is described and satisfactory results were noted.

3. The disease in epidemic form is described as being of relatively little significance when compared with the sporadic chronic form of superficial punctate keratitis seen occasionally in ophthalmic practice.

4. The pathological findings were inconclusive.

5. Epidemiological factors related to climate and to possible trauma are mentioned, but no final conclusions are drawn.

Acknowledgement.

I wish to thank the Director-General of Medical Services for permission to publish this report.

Reports of Cases.

METASTASIZING ADAMANTINOMA-LIKE GROWTH INVADING THE SKULL AND EARLY CARCINOMA OF THE PROSTATE.

By JOHN D. LE SOUËF,
Medical Student, University of Adelaide.

Clinical Record.

J.R., A MALE PATIENT, aged sixty-five years, was first admitted to the Royal Adelaide Hospital in September, 1945, suffering from a corneal ulcer and a pterygium in the left eye. He then complained of impaired vision, which was growing worse. He had had diplopia for twelve months, and he also complained of pain in his left eye; there was no discharge and the eye was photophobic. The margins of the optic disk were found to be blurred, his cornea was clear and the ocular tension was normal. He was readmitted to hospital about a month later with lagophthalmos, and blepharorrhaphy was performed. He next appeared at the hospital in January, 1946. He was found still to have a corneal ulcer in the left eye and also paralysis of the following left cranial nerves: third, fourth, first division of the fifth, sixth and seventh.

It was thought that nothing could be done for him and he was discharged from hospital, only to be readmitted in April, about four months later. He then had neuropathic keratitis in his left eye. The pupil was dilated and the cornea steamy. His reflexes were active and there was no pronounced diversity in activity between the two sides, except on the abdomen, where the reflexes on the left were absent. His left arm and leg were weaker than his right. The lungs were clinically clear. On rectal examination his prostate was felt to be moderately enlarged; the surface was firm and regular and the mucosa moved freely over it. A lumbar puncture was performed, and the cerebro-spinal fluid was found to contain 105 red cells per cubic millimetre, no excess of globulin and 100 milligrammes *per centum* of protein. The fluid was clear and colourless, the pressure being 200 millimetres of water. Queckenstedt's test produced a positive reaction. The result of Lange's colloidal gold curve test was as follows: 1123310000. X-ray examination of his chest revealed an opacity at the apex of the right lung suggestive of collapse. X-ray examination of the skull revealed no abnormality. The Wassermann test failed to produce a reaction with either blood or cerebro-spinal fluid. During no part of his illness was the patient pyrexial. His general condition deteriorated and he eventually died after one month in hospital.

Autopsy.

An autopsy was performed (Royal Adelaide Hospital post-mortem examination number 118/46). The subject was a man looking more than his age, emaciated and edentulous; *rigor mortis* was pronounced. When the chest was opened extensive adhesions were found over most of the left lung anteriorly. In the skull very little atheroma of the vessels at the base of the brain was found. There was a tendency for the left temporo-sphenoidal lobe to adhere to a malignant infiltration in the left middle fossa. A small yellowish patch was noted on the underside of the left frontal lobe over the growth, probably due to pressure atrophy. In the left middle fossa were numerous nodular elevations extending forward one-third of the way across the cribriform plate, infiltrating around the right optic nerve. The left antrum seemed to be free. The growth surrounded the left optic nerve and infiltrated the roof of the orbit; it also penetrated deeply into the structures behind the left maxillary antrum. The growth was itself surrounded by a good deal of hæmorrhage. In the brain was a patch of softening in the right lenticular nucleus. The hypophysis proved to be enlarged to about the size of a bean. In the lungs mucopus was found in the bronchi, and considerable emphysema was present in the anterior thirds. The tracheal glands seemed normal. About one-third of the way down the lateral aspect of the lower lobe of each lung a firm area could be felt. There was a patch in the upper lobe of the right lung, one and a half inches across, which resembled a patch of pneumonia. Pus oozed from a bronchiole near it. No abnormality was noted in connexion with the heart. The pancreas, duodenum and small and large intestines and stomach were normal. There were two small raised plaques in the right pyriform fossa which were not ulcerating, and some leucoplakic patches in the œsophagus. The bladder wall was rather thick and contracted. The middle lobe of the prostate was found to be firmer than the rest. The liver was slightly congested. The spleen was small, dark red and rather firm. The kidneys were rather dark, the capsules peeled fairly readily and the cortex was not reduced. The testes were normal.

In summary, the autopsy findings were as follows: massive malignant infiltration of the structures behind the left maxillary antrum extending towards the left middle fossa, with nodular infiltration of the dura of the middle fossa and extending across the mid-line; patches in both lungs—possibly pneumonia; leucoplakia; two small cyst-like elevations in the right pyriform fossa.

Examination of a section of the pituitary body revealed infiltration with what looked like an adamantinoma. It was composed of sheets of small epithelial cells which were more elongated around the periphery—that is, the growing edge. The central cells did not break down into a kind of stellate reticulum, and the appearance was not unlike that of a rodent ulcer. In a section of the dura was found a tumour similar to that invading the pituitary body. Examination of sections of the prostate revealed some dilated acini containing pink granular material; some pigmented laminated concretions, considerable hyperplasia, a good deal of fibrosis and a carcinomatous infiltration which proved to be an adenocarcinoma were also found. The cells of this adenocarcinoma were larger than those in the other growth and in places had a definite glandular arrangement. In sections of the lungs were seen numerous macrophages in the alveoli, often with ingested cells, and also red cells and polymorphonuclear leucocytes. In places there was some thickening of the alveolar walls. In the pulmonary artery and its branches was present what appeared to be a deposit of carcinoma cells. It looked as though the cells had formed an infarct. In the wall of one vessel the cells were numerous, evidently in perivascular lymphatics. The deposits in the lung had stained well and were clearly of the same type of cell as had been seen in the growth on the dura.

The growth in the prostate was probably just commencing and was still small, whereas the other growth was well developed and no doubt had a hand in killing the patient. It might have been anticipated that the advanced growth would have inhibited the growth of a carcinoma elsewhere.

Discussion.

The feature of interest in this case lies in the fact that an adamantinoma-like growth was found in conjunction with an adenocarcinoma of the prostate; the former new-growth had metastasized and this, according to Boyd,[1] is a rare occurrence. Many cases of adamantinomata and carcinomatous growths of the head and neck have been described; amongst them are those of Coote (1857),[2] Eve (1883),[3] Heath (1887),[4] Cleland (1903),[5] Duffy (1920),[6] Bump (1927),[7] Kegal (1933).[8]

As to the origin of the newgrowth in the skull, in the case under consideration it would seem highly improbable that this was secondary to the growth in the prostate, because the two neoplasms differed greatly histologically, as has been seen earlier. It is doubtful also whether the growth arose from the maxillary antrum, as this seemed to be free at the post-mortem examination. Adamantinomata, according to MacCallum,[9] are derived from the enamel organ, which is the epithelial structure of the developing tooth concerned in the formation of enamel; but in this case the growth seemed to have no connexion with the alveolus. Cleland and Hansen (1934)[10] described

three cases of epitheliomatous tumours of the upper part of the neck with cells presenting transitional appearance or suggesting a basal-cell type, the origin probably being from branchial epithelium. These authors presented arguments in support of an origin from remnants of the branchial epithelium, and to such an origin they attributed some (probably the majority of) carcinomatous growths in the neck. They considered that an origin from displaced surface epithelial cells, if it ever happened, was only a freak occurrence.

The tumour clearly must have originated from one of the epithelial structures of the air sinuses and their accessories. The potentiality to form a tumour of adamantinomatous type is evidently not confined entirely to the epithelial tooth band which gives rise to the enamel organ, but is present also in other adjacent epithelial structures, such as those of Rathke's pouch under certain conditions, and is probably latent in all their epithelial derivations. Professor E. Weston Hurst, formerly of Adelaide, diagnosed as an adamantinoma a tumour situated in the base of the brain, apparently away from the derivations of Rathke's pouch.

The occurrence of two different carcinomatous growths in the same case is of interest. However, numerous cases of two primary malignant neoplasms arising in the same subject have been recorded. Renaud (1921) described the simultaneous occurrence of a squamous carcinoma of the left parieto-frontal region with a basal-celled carcinoma of the right temporal region. In 7,207 autopsies at Saint Mary's Hospital, London, there were eight cases of multiple malignant tumours, four of the patients being females and four males (Orr, 1930). Orr further states that he does not think that there is any ætiological relationship between multiple malignant tumours occurring in the body, and hence does not think that one malignant tumour exercises any influence over the development of a second. Murray,[12] on the other hand, discusses the evidence available as to the inhibiting effect of the presence of one newgrowth on the development of others. He considers that there is probably no essential difference between a true simple neoplasm and a malignant neoplasm, and calls attention to the infrequency with which multiple malignant newgrowths are found at autopsy. It would appear that the occurrence of one carcinoma is rarely accompanied by the presence of another independent carcinomatous growth. The presence of even a benign tumour with a malignant tumour is also decidedly less frequent than one might expect mathematically if there was no inhibiting effect of the one growth on the development of the other. Murray showed by his experiments on mice that once a malignant growth has developed it acts in some way as a definite inhibiting factor on the development of malignant growths in other parts of the body, even when these are irritated. It is interesting to note that carcinoma of the prostate is controlled to some extent by hormones, and that carcinoma developed in spite of an already advanced malignant growth in the skull.

Summary.

1. A case is described of a carcinoma presenting the appearance of an adamantinoma invading the middle fossa of the skull from the deeper parts. Embolic secondary deposits in the lung and an early adenocarcinoma of the prostate were present.

2. The possible source of the adamantinoma is briefly discussed.

3. Attention is drawn to the incidence of two concurrent primary growths.

Acknowledgements.

I am particularly indebted to Professor J. B. Cleland, of the University of Adelaide, for his help in the preparation of this article, and also to Dr. M. Schneider, of the Royal Adelaide Hospital, for permission to publish the case.

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A CASE OF TETANUS TREATED WITH ANTI-TETANUS SERUM INTRAVENOUSLY AND PENICILLIN SUBCUTANEOUSLY.

By RICHARD T. KENNEDY,
Sydney.

THE following case is reported because of the rapid response to large doses of anti-tetanus serum given by the intravenous route only, associated with the subcutaneous administration of penicillin.

Clinical Record.

A.M., a male patient, aged twenty-four years, a shearer, was admitted to hospital on July 10, 1945, at 9.30 p.m., obviously suffering from tetanus. At a later date when recovery had ensued and he could be questioned, he stated that he had first noticed some stiffness in the right arm on the morning of July 7 while "crutching" sheep in the mountains, but he continued his work, thinking the stiffness no more than the result of a "yolk-boil", a furuncular condition common on the arms of shearers. The "yolk-boil" had been discharging pus for some ten days prior to the occurrence of the stiffness. On July 2 he had been "penning" sheep and had run a splinter under his right thumb-nail. It was a quarter of an inch long and was removed by a fellow shearer with a needle. A small piece of the splinter was still present when he was admitted to hospital, but there was no inflammation. The stiffness in the right arm gradually increased, and by the morning of July 8 it had spread to involve the right chest muscles. By the afternoon of July 9 his jaws had become difficult to open; but he attempted to carry on "crutching" the sheep. His condition became worse, however, and he was put into his bunk. He arose with great difficulty next morning, July 10, feeling very stiff all over; this stiffness was particularly pronounced in the right arm and he now found it impossible to open his jaws at all and was "getting cramps all over all the time". He lay up against the shed fire all the morning trying to "warm up and loosen up his limbs and relieve the cramps". He was carried from the shearers' quarters that afternoon and placed in a motor truck, intending to travel 200 miles to his home. Two tire "blow-outs" occurred in the first 90 miles. While these were being repaired on the roadside, he sat fixedly in the cold, open truck, suffering agony from repeated reflex spasms. He was admitted to hospital some six hours after leaving the shearing shed.

Examination showed the patient to be a strong, muscular young man. He had typical, severe, opisthotonic spasms at

the least touch and cried out with pain at every moment. *Risus sardonicus* was evident. The "yolk-boil" was almost healed. A small scab on the knuckle of the index finger and a small splinter beneath the right thumb-nail were observed. There was no history of his ever having received any serum for any purpose heretofore; a skin test revealed no sensitivity.

He was immediately given 240,000 units (United States of America) of undiluted anti-tetanus serum (Commonwealth Serum Laboratories) into the left cubital vein. The administration of penicillin ("Commonwealth") was commenced in doses of 10,000 Oxford units, dissolved in two millilitres of sterile distilled water, every two hours by subcutaneous injection with a hypodermic needle. Spasms were so frequent and severe that any attempt to deliver penicillin by any other route was impossible.

The following doses of undiluted anti-tetanus serum were given intravenously (Table I).

TABLE I.

Day of Treatment.	Units of Serum. (U.S.A.)
First—	
p.m.	240,000
Second—	
a.m.	66,000
p.m.	100,000
Third—	
a.m.	130,000
p.m.	150,000
Fourth—	
a.m.	120,000
p.m.	100,000
Fifth—	
a.m.	80,000
p.m.	70,000
Sixth—	
a.m.	50,000
p.m.	50,000

Penicillin was administered continuously throughout to a total dosage of 720,000 Oxford units. Variation in the size of doses of serum in the first three days was due to difficulty in obtaining supplies.

On the morning of the seventh day of treatment the patient showed a commencing serum rash, urticarial in nature. In view of this and of the improvement manifested on the fifth day, all treatment with both serum and penicillin was suspended then and thereafter. The serum rash lasted for two days, and apart from itching was not severe or remarkable. To counteract a basal pulmonary congestive condition from the enforced supine nursing posture, which had appeared first on the fourth day, he was given sulphadiazine to replace the penicillin. This administration was suspended on the sixteenth day of treatment.

The first four days were indeed stormy and at times the case seemed almost beyond hope. However, improvement measured by reduction in the number and severity of reflex spasms began quite distinctly on the fifth day of treatment and spasms were reduced to negligible quantities by the eleventh day, although troublesome generalized rigidity was still present and the patient had to be fed on liquids and semi-liquids owing to jaw stiffness. One fearful spasm occurred on the eighth day in which a *status rigidus* developed necessitating artificial respiration and then the inhalation of chloroform to control the succeeding vicious spasm. The day otherwise had been comparatively free of reflex spasms and the *status rigidus* followed an attempt to relieve the long unopened bowel by an enema, no bowel action having occurred since his admission to hospital. A further similar attack took place for no apparent reason that same night and was similarly treated. Thereafter spasms were not serious, nor indeed had they been after the fifth day, save for the two occasions just mentioned. Sedatives given varied between phenobarbital, "Sonalgin", "Nembutal" and heroin, all in large doses and with a constant undercurrent of bromide three times a day. Heroin was generally given thirty minutes before the intravenous injections of serum, as the spasms made administration most difficult.

The temperature remained elevated for the first five days and the pulse rapid. Both returned to normal about the fifth and sixth days.

The patient was allowed out of bed on the twenty-second day of treatment, and recovery thereafter was assured, although stiffness, particularly in the right arm, remained throughout convalescence. An interesting complication occurred during the last few days in hospital—a condition that was adjudged to be due to serum reaction.[a] Winging of the scapula developed, due to paralysis of the *serratus magnus* and associated weakness of the deltoid muscle. No great pain was felt, but the stiffness and heaviness of the arm were troublesome and the arm ached at night. This occurred only in connexion with the right shoulder and was almost certainly due to serum-therapy neuritis. On September 10 it was noted that winging of the scapula was still present, but less pronounced; but the patient could not abduct the arm beyond 90° (an improvement) unless the scapula was pressed firmly against the ribs. At the time of writing (April, 1946) winging is almost negligible and the arm has good function. He now plays tennis as well as ever. His general condition is excellent.

Comment.

So much difference of opinion exists from year to year, and from clinician to clinician, concerning the necessity or otherwise of repeating the large initial dose of anti-tetanus serum, that no good reason could be deduced from this case to recommend cessation of administration until some evidence of clinical improvement was manifest. The rapid change in five days from a condition almost of despair to one of supreme optimism of cure must, it is thought, be placed to the credit of large serum dosage combined with the miracle that is penicillin.

In conformity with general clinical opinion, the brachial neuritis completely recovered in the usual six months.

Reference.

[a] "The British Encyclopaedia of Medical Practice", Volume IX, 1938, page 197.

A FOREIGN BODY IMPACTED AT THE UPPER OPENING OF THE ŒSOPHAGUS FOR OVER FIVE WEEKS.

By CLIFFORD L. ROSEFIELD,

Assistant Surgeon to the Ear, Nose and Throat Department, Alfred Hospital, Melbourne.

Clinical Record.

SERGEANT McF. was admitted to the ear, nose and throat department of the 115th (Heidelberg) Military Hospital on February 11, 1946, complaining of difficulty in swallowing solid food and of slight soreness of the throat since a "fainting attack" on January 5, 1946, while he was stationed at Morotai. According to notes made at the Second/Ninth Australian General Hospital at Morotai, he was unconscious for about two hours during that attack, and on recovering he complained of soreness of the throat and of difficulty in swallowing. Examinations of the throat in the following days disclosed follicular tonsillitis with mild pyrexia, and appropriate treatment was given, which included penicillin and sulphonamide drugs. The acute soreness and pyrexia subsided; but the dysphagia persisted, and the patient was still unable to swallow solids after two weeks. The cervical region was radiologically examined at this stage, about January 22, 1946, and two apparently separate wire-like metallic foreign bodies were seen, one at the level of the hyoid bone, and the other at the level of the cricoid cartilage. He was evacuated from Morotai by aeroplane towards the end of January, and was admitted to the 112th (Brisbane) General Hospital, where he was again radiologically examined with

the same result as previously. There was a delay of several days again before his further evacuation south.

When his history was taken at Heidelberg, the information was elicited that he had not seen his partial upper denture since the "fainting attack", and that he had sent his tent mates on a fruitless search for it while he was still in hospital at Morotai. A laryngoscope was passed under local anæsthesia on February 12, and an acrylic denture was found, the upper presenting margin with its metal clasp directly posterior to the base of the epiglottis, and the lower margin with its metal clasp impacted in the right pyriform fossa. The plate was removed intact after a certain amount of manipulation and with a moderate amount of hæmorrhage, and the swelling of the surrounding tissues, which was considerable and included the epiglottis, subsided during the succeeding days. Recovery was uneventful; but the patient had a typical epileptiform seizure about one week after the removal of the denture.

Comment.

This case is reported to emphasize the fact that acrylic material of which dentures are made is radio-translucent, and that the teeth on many plates are also of acrylic. The fact that the two wire-like metallic foreign bodies were connected to a radio-translucent denture on which were five radio-translucent teeth was apparently not appreciated in the hospitals at Morotai or Brisbane.

An interesting feature of the case is the fact that the somewhat sharp clasp of the denture remained impacted in the upper part of the wall of the œsophagus for more than five weeks, and produced considerable local reaction while *in situ*; but this subsided rapidly without complications after the removal of the foreign body.

Finally, it is pointed out that some dentures are made without metal clasps, so that X-ray examination would be of no value in locating them, should they become impacted in the air or food passages, and the diagnosis would depend entirely on endoscopy in such cases.

Reviews.

ANTE-NATAL AND POST-NATAL CARE.

AFTER a period of two years Francis Browne has produced a sixth edition of "Antenatal and Postnatal Care".[1] The author states that the book has been revised throughout. However, there are no radical changes in the text. Alterations have been found necessary chiefly in the chapters on erythroblastosis and the Rh factor, on *placenta prævia*, on the toxæmias of late pregnancy and on venereal disease in pregnancy. Short sections have been added on acroparæsthesia, on angular pregnancy and on the influence of rubella causing congenital abnormalities. The work of Australian investigators on effects of rubella in pregnancy has thus received discussion in this textbook for the first time.

The chapter on radiology in obstetrics has again been revised by Professor Chassar Moir.

A book that has gone through six editions in eleven years does not need further comment. It is one of the essential books for all those engaged in the practice of obstetrics.

ANATOMY AND PHYSIOLOGY FOR NURSES.

"ANATOMY AND PHYSIOLOGY FOR NURSES" has been written in an attempt to overcome the difficulties of these subjects for nurses.[2] The author considers these obstacles arise from three causes—the nurses' ignorance of biology, the absence of dissecting room or post-mortem instruction, and their bewilderment with a terminology based mainly on Latin and Greek. At the age of sixteen, Queen Elizabeth could talk Latin with her tutors readily and well, but this could scarcely be expected of anyone today. An appendix contains a glossary of anatomical terms giving their Latin and Greek roots.

The book is arranged as follows. In the first chapter a simplified account of the tissues and systems of the body is given with an explanation of some common descriptive terms. There follow nine chapters giving the elementary anatomy and physiology of the separate systems. Chapter XI deals with histology. It would have been more satisfactory if this material had been scattered in appropriate places through the preceding chapters. The last five chapters are devoted to more detailed regional anatomy of the various parts, namely, thorax, abdomen, lower limb, upper limb and head and neck.

As well as the glossary mentioned above, some English nurses' examination papers are included and an index is provided.

Our main criticism is an unusual one—the book is too small. To dispose of the genito-urinary system in two and a half pages of text and two pages of drawings is hardly a compliment to a nurse's intelligence. The physiology of the alimentary canal and its associated organs receives only two pages—a real peristaltic rush. We suggest that the author enlarge the book in order to give the nurse (purely metaphorically) more meat and less dressing. The method is sound.

APPLIED PHYSIOLOGY.

IMPORTANT changes in the fourth edition of Best and Taylor's "Physiological Basis of Medical Practice" are the two-column format, a slightly reduced print size, a reduction in the page numbers from 1,942 to 1,169 and an increase in the book size which is now seven inches by ten inches as opposed to six inches by nine inches.[1] These changes make the volume easier to handle than the previous editions. Furthermore, a six to eight word line is much easier to read quickly than a ten to twelve word line. This in itself is sufficient justification for altering the format. Many of the illustrations in the text have been reduced in size and new figures have been added, but there has been no abridgement of the content. Typographical errors, an inevitable consequence of altering the format, can be found on pages 178, 378, 493, 587 and 744.

The word pericardium does not appear in the index even though a paragraph is devoted to adherent pericardium and pericarditis in the section on pathological variations in the cardiac output. In a volume as comprehensive as this it seems unfortunate that a little more space could not be found for a discussion of the functions of the pericardium in health and disease.

The view of the authors on the cause of the first heart sound has undergone an interesting retrenchment since the publication of the third edition. Physical methods for the measurement of cardiac output, including atrial catheterization, are discussed and the information on the special features of the coronary circulation has been revised.

A short discussion on blast injury and anaphylaxis has been added to the section on shock.

The section on intracellular oxidation and the biological transformation of energy has been revised and enlarged considerably.

Information on the possible relation of pressor amines to the production of hypertension has been summarized in greater detail than in the third edition.

Recent ideas on the nature of prothrombin and thromboplastin are to be found in the discussion on blood coagulation. *Erythroblastosis fœtalis* and agglutinogens M and N are mentioned briefly. The estimation of blood volume by use of the dye T-1824 replaces the vital red method in the text.

Greater detail of the inulin clearance test as a means of assessing kidney function has been included and the section on gastric digestion has been revised.

Though the above summary indicates only some of the changes that have been made in this edition, it is probably sufficient to indicate that "The Physiological Basis of Medical Practice" is still supreme in the field of medical physiology.

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[1] "Antenatal and Postnatal Care", by Francis J. Browne, M.D. (Aberdeen), D.Sc., F.R.C.S. (Edinburgh), F.R.C.O.G.; Sixth Edition; 1946. London: J. and A. Churchill Limited. 8" × 5¼", pp. 652, with many illustrations. Price: 25s.

[2] "Anatomy and Physiology for Nurses", by J. L. Hamilton-Paterson, M.D.; 1946. London: H. K. Lewis and Company, Limited. 8½" × 5½", pp. 184, with 102 illustrations. Price: 9s. net.

[1] "The Physiological Basis of Medical Practice: A University of Toronto Text in Applied Physiology", by Charles Herbert Best, C.B.E., M.A., D.Sc. (London), F.R.S., F.R.C.P. (Canada), and Norman Burke Taylor, V.D., M.D., F.R.S. (Canada), F.R.C.S. (Edinburgh), F.R.C.P. (Canada), M.R.C.S. (England), L.R.C.P. (London); Fourth Edition; 1946. London: Baillière, Tindall and Cox. 10" × 6½", pp. 1,186, with many illustrations. Price: 55s.

The Medical Journal of Australia

SATURDAY, DECEMBER 14, 1946.

All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without abbreviation: initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

Authors who are not accustomed to preparing drawings or photographic prints for reproduction are invited to seek the advice of the Editor.

THE PRE-SCHOOL CHILD.

THERE must surely be few people today who would deny to everyone in the community full opportunities to attain personal health, to follow any calling that they might choose, and to pursue the cultural side of life to their heart's content. Indeed the view is commonly held that these opportunities should be provided and that the community will not be properly equipped until this is done and the general run of people know at least something of what life has to give them. Most people who have these convictions are probably concerned chiefly with what is due to the individual, but the individual is only one unit in a composite whole and the communal point of view must not be forgotten. Though educational experts will almost certainly claim a major responsibility in this matter and social workers of various kinds will look on their efforts as indispensable, medical practitioners have duties no less important. More than any other group in the community they are the curators of man, the guardians of his mental and bodily health, without which he cannot grow to his full stature in quality and attainment. This is, of course, well known to members of the medical profession; it is not so patent to other groups of persons. Educational experts, for example, often look with mild tolerance on what they call the amateur dabblings of doctors in matters which, they think, lie almost completely within their own province. But even doctors need to be reminded from time to time of the extent of the field that they ought to cover, for medical sociology is easily pushed on one side by the immediate and therefore more pressing problems of everyday curative medicine. What we have called man's full stature in quality and attainment cannot be readily achieved if he is handicapped at the outset. Handicaps do exist; they are sometimes of hereditary origin and may also arise in the environment. Some can be removed, some can be lessened and some unfortunately must remain, but a surprising number of them come within the purview of the medical practitioner. In his everyday practice the family doctor has opportunities for dealing with conditions that stand in the way of his patient's full development, and what he does is included in the term preventive medicine. In industry the need for the continual adoption of preventive measures in the medical sphere is widely recognized and more is being done every day in this direction. The school child has medical services devoted to his welfare. It is true that these services are not in every place provided with the staff and equipment that are necessary and it may also be true that the methods used are sometimes ineffective. What is important is that the care of the school child is recognized in every State of the Commonwealth as an essential part of the practice of preventive medicine. Neither the members of the medical profession nor the public need to be reminded of the care that should be taken of the *fœtus in utero*, for in the practice of obstetrics ante-natal care is looked on as part of everyday practice. The one period of life which is often overlooked is the pre-school period. This is curious, for it is the most important period in the child's development, when the groundwork of his character and habits is formed and the future of his life may thus be in large measure determined. A certain amount is actually being done, as the development of kindergarten systems and the inauguration of the Lady Gowrie centres show; but a great deal more remains to be done and the whole work needs to be regarded and accepted as an essential part of the preventive medicine activities of the community.

The deficiencies that exist throughout the Commonwealth at the present time in the facilities for promoting the welfare of the pre-school child have been set out in a recent survey by John Bostock, research professor of medical psychology and lecturer in psychiatry of the University of Queensland, and Edna Hill, child care convener of the National Council of Women of Australia.[1] As a matter of fact the book is more than a mere survey, because the authors begin by discussing the importance of the pre-school years and the foundations of parenthood. They describe the available facilities for work directed to the welfare of the pre-school child in chapters devoted successively to organized services for infant welfare work, social security, positive health and the handicapped child. They conclude by making suggestions for a solution. Since the care of the pre-school child is part of the communal practice of preventive medicine, it is natural that the foundations of parenthood should be discussed as a preliminary step. No aspect or period of man's life can be adequately considered without reference to the phase that has preceded it or to the stages that follow it and may be influenced by it. This is another way of saying that man is not a creature of the moment or even a shadow of the future; his extrauterine life is really one entity from the moment of birth till the hour of death. This means that what an individual is or does at any moment of his existence is with him, in spite of what he may become, until the day of his death. If we try to think of man in this way we shall have no difficulty, when we come to preventive medicine and apply it to the individual, in looking on it as a necessary and continuous process. We can then agree with the authors of this book that it is necessary to plan lest the child's development be side-

[1] "The Pre-School Child and Society: A Study of Australian Conditions and their Repercussions on National Welfare", by John Bostock and Edna Hill; 1946. Brisbane: The University of Queensland. 6" × 8¼", pp. 221, with illustrations. Price: 18s.

tracked by the multiple sensations and impressions which are a part of our present-day life. If plans are to be made they will have to be made by the parents of the child, and this leads to the need for the education of parents. This means education before the birth of the child as well as during its early years. How this can be attempted would need a separate discussion. We read that the State of Victoria through its infant welfare movement, its Free Kindergarten Union and its Nursery-Kindergarten Extension Board has covered a wider field in parent education work than any other State. Whether an organization such as a "family consultation bureau", of the kind envisaged by our authors, should be established is open to argument. Many will hold that existing agencies and organizations should be developed and used before any fresh agency is contemplated. Be that as it may, no one will deny that such questions as those of housing and nutrition cannot be omitted from a discussion on the pre-school child. The whole social framework of society needs to be examined that environmental handicaps to the child's welfare may be removed. Child endowment was introduced with the best possible intentions and no doubt it has often been of material benefit, but the authors of this book state that it is inadequate. In fact they go so far as to state that the *Child Endowment Act* is based on the entirely erroneous assumption that the child needs money, whereas it "actually needs food, shelter, clothing, education and material assistance". We agree that too many parents have no idea of getting the best value from the money for the child. This brings us back to the question of education of parents. We are told that the Government has to some extent recognized the need for the education of parents in the real needs of their children by sponsoring the Lady Gowrie Child Centres and by collaborating with the Australian Association for Pre-School Child Development, but that these institutions come into contact with only a fraction of the population. Though the State looks after the school child, there are, our authors declare, few facilities for the pre-school child. "Those who have studied this question closely are convinced that the national use of kindergartens is essential for our national health." There are at present 250 kindergarteners working in Australia's 90 free kindergartens to meet the needs of 740,000 pre-school children. From Australian kindergarten training colleges only 70 trained kindergarten graduates pass out each year after having received three years' training. Even if existing training facilities were doubled at once, it would be possible to open a maximum of only 150 new kindergartens in the next five years. Incidentally Western Australia is the only State in which general registration of kindergartens is required by law. A similar act has been passed in New South Wales, but has not been implemented. Clearly a great deal requires to be done about kindergartens. It is satisfactory to know that quite recently a departmental medical officer has been appointed in Victoria to inspect children attending kindergarten schools. When we turn to the handicapped children in the community we realize how enormous is the problem of pre-school child welfare. The types of children named are the blind, the deaf, the dumb, the spastic, the mentally defective, the psychologically maladjusted, the orphans and the State wards. In support of a plea for the determination of the number of handicapped children in the community the statement is made that a maladjusted child who has to be kept from infancy to an age of fifty years, costs the community a sum of £4,000. This should be enough to make us think seriously about the matter.

We have stated that the authors discuss a solution of the problem. They hold that in a problem with such wide ramifications incoordinated freedom of action could run riot. They think that central direction is necessary and hold that this can come only from the Commonwealth Government. The next step in their opinion is for the Commonwealth Government to set up a Royal Commission to report on the whole problem. They would give the commission wide terms of reference (they set them out in detail) and would include in its personnel medical and educational authorities, a psychiatrist, a sociologist, representatives of voluntary associations, the trades unions, industry, the local authorities and the Government. This would be an enormous commission. Surely the groups named are those from whom evidence should be obtained. A large commission would be unwieldy. If a survey was to be made to discover the number of handicapped children in the community, a small committee could do the work, or it might be done by local personnel in different centres acting on the direction of a central officer. The work of a commission would be different. A large body would not be needed. Though many persons suspect royal commissions as being essentially the kind of body that provides material for departmental pigeonholes, we cannot forget the valuable document produced more than twenty years ago by the Royal Commission on Health and the fact that numbers of its findings have been put into effect. The effectiveness of a commission depends on the sincerity of the intentions of the government which sets it up. If the government wills, it can do a great deal without a commission; a commission with an earnest and sincere government serves only as a justification for the taking of steps to which supporters or opponents may object. To this we would add that the problem of the pre-school child is admittedly one of medical, educational and social conditions. It is also in no small degree the problem of the present topsy-turveydom in society generally—the lack of personal restraint that abounds, the loss of feelings of personal responsibility in all sections of society and the abandonment of religious faith and practice that is so widespread. Unless something happens about these things, the findings of a Royal Commission on the pre-school child carried out to the letter will effect only a flimsy and superficial patchwork.

Current Comment.

CAROTENE AND VITAMIN A.

THE attitude of biochemists towards the relationship of carotene to vitamin *A* has undergone some interesting changes. In the early days of vitamin research, *A*, the "growth factor", as it was rather erroneously called, was regarded as associated in some curious way with yellow colour, but not as identical with carotene, the most widespread organic pigment in Nature apart from the chlorophyll group. That is to say, a richly yellow butter was more likely to contain *A* than a pallid butter, but it was held that there was complete divergence between the vitamin and the pigment. A margarine made from yellow vegetable oil was looked upon as totally unfit to take the

place of butter as regards the supply of vitamin *A*. The point of view changed when it was shown that carotene could be changed within the body into the vitamin. Research, both chemical and physiological, became active. It is now known that vitamin *A* can have at least five precursors in human diet, four carotenes and cryptoxanthene, and of these, β carotene is unquestionably the chief as regards both available quantity and ease of conversion. The bulk of evidence today favours the view that the transformation takes place in the liver, though it must be admitted that some loose thinking was occasionally too obvious. For example, a diseased liver was associated with vitamin *A* deficiency, and this was adduced as a proof that the liver was the site of the change, whereas the simple explanation is that vitamin *A* is fat-soluble and requires bile for its absorption. Against the opinion that the liver is the responsible organ are the experiments of Sexton, Mehl and Deuel, who claimed to demonstrate that the liver can store unchanged carotene, introduced parenterally, even when the animal is suffering from vitamin *A* deficiency.[1] Later evidence, however, strongly supports the hepatic hypothesis.

The next great problem was the chemical nature of the transformation and how to effect this *in vitro*. Carotene may be regarded as a chain of carbon atoms with a methylated hexacyclic complex placed symmetrically at each end of the chain. In this chain five double bonds are present, but special significance is attached to one in the centre, for it is through an oxidative attack on this that the vitamin is formed. At one time it was thought that a molecule of β carotene could give rise to two molecules of vitamin *A* through oxidative bisection, but this view has been abandoned; indeed some of the carotenes other than β must sacrifice two molecules to give one molecule of vitamin. Just how to oxidize this central double bond without affecting the other double bonds in the chain or in the hexacyclic appendages was the most pressing problem facing the organic chemist. Oxidation by permanganates and other laboratory agents proved unsuccessful.

At last R. F. Hunter, by using peroxides at body temperature, managed to transform 0·5% to 1% of the carotene into what was proved by chemical tests and biological assay to be truly vitamin *A*.[2] So far efforts to increase the yield have not been successful. There is much accumulated evidence that the transformation of carotene into vitamin *A* in the living body requires the presence of glycerides of unsaturated fatty acids, which in some way allow the central double bond to be attacked, but shield the other vulnerable parts of the molecule. Animals differ in their capacity to utilize carotene as a provitamin; rats are perhaps the most efficient in this respect, whilst carnivorous animals are the least efficient. The human body has no apparent difficulty with the four carotenes, but there are indications that cryptoxanthene is not so easily transformed.[3] Another complexity is that the presence of vitamin *E* can facilitate the utilization of carotene, probably as a damping agent on oxidation taking place in the alimentary canal. Amongst the curiosities of comparative physiology is the fact that the plasma of the cow, when normally nurtured, contains carotene in relative abundance, whereas the plasma of the sheep and goat contains none.

[1] *Journal of Nutrition*, Volume XXXI, 1946, page 299.
[2] *Nature*, August 24, 1946, page 257.
[3] See article on vitamins by H. R. Rosenberg in "The Chemistry and Technology of Food and Food Products", edited by Morris B. Jacobs, 1944.

PENICILLIN TREATMENT IN SUBACUTE BACTERIAL ENDOCARDITIS.

SUBACUTE bacterial endocarditis, a disease that has resisted almost all attempts at cure, seems at last to be yielding to penicillin. The theoretical barriers to cure are familiar; they are anatomical rather than immunological. It is well known that the sufferer has immune bodies in his blood; even the secondary embolic lesions are usually mild in the bacteriological sense, however serious they may be otherwise. But the principle of continued onslaught has proved very hopeful. If a non-toxic antibiotic agent can be kept constantly attacking, with continued reinforcements, there is a hope that the colonization of the organisms on the wall of the heart and the valves will be prevented, and that finally the living enemy within the heart may be immobilized and finally slain. There is, of course, always the possibility of survivors, and also of fresh crops of invaders which may settle on the weakened areas. The treatment of bacterial endocarditis was discussed at some length by both J. A. Halliday and Jean Armytage in their papers read before the New South Wales Branch of the British Medical Association and published in the issue of November 23, 1946. To counter the possibility of survivors the idea of maintenance treatment has been suggested and to some extent carried out. There is, however, one person in all this optimistic planning who must not be forgotten. Even in short sharp illnesses treated by penicillin the repeated injections are dreaded by the patients, and continuous parenteral administration of one kind and another does not solve this problem entirely. Efforts have been made to prolong the effective period of a given dose of penicillin. A recent success along these lines is recorded by A. J. Geiger and J. R. Goerner.[1]

Suspensions of penicillin in various media have been tried; of these vehicles for the drug one of the most promising to date seems to be a mixture of peanut oil and beeswax. Gonorrhœa has been treated with penicillin suspended in this mixture with encouraging results. The present authors have seized upon the valuable opportunity for critical observations in the treatment of a patient with subacute bacterial endocarditis. This man was not cured by water-soluble penicillin, but if he received at least 250,000 units of penicillin by injection each day, either in two-hourly intramuscular injections or by continuous intravenous drip, he remained free from symptoms and without fever, and bacteria could not be grown from the blood. Obviously if a single daily injection could replace either trying ordeal it would be a great boon. This result was actually achieved by the use of penicillin in peanut oil and beeswax. The patient was a man, aged forty-five years, with a typical infection by *Streptococcus viridans* and lesions of both mitral and aortic valves. His fortitude must have been sorely tried, for he was treated over a period of ten months. Surely the period which followed in which he was given a single injection daily must have been almost a luxury, even though a clinical and bacteriological cure has not been attained. When the treatment is intermitted bacteria return to the blood and an Osler's node has appeared. However, he has returned to work successfully, and has remained free of fever while the treatment is maintained. This success encouraged the authors to pursue the same method with other patients. One middle-aged woman was first treated in the conventional way, with frequent dosage by water-soluble penicillin, and later by the oily preparation. A limited period of observation seems to show that she may be cured, as no organisms can be grown from the blood and she remains well. A third patient was treated with the delayed action penicillin alone. In this case a single dose of penicillin given intramuscularly in peanut oil and beeswax gave satisfactory blood concentrations after twelve hours, so this interval was chosen. Five weeks' treatment has produced a remission which has so far been complete, and the authors hope it will be permanent. It has been found that the concentration of the drug in the serum is satisfactory for twelve hours, and appreciable amounts are still found after twenty-four hours. Some discomfort is felt by some patients after the injections. This amounts to considerable tenderness in some instances, and local erythema has been observed. There are also some technical difficulties in giving injections of a material which is fluid only at an appropriate temperature, but these have easily been overcome. The two last-mentioned cases presented favourable circumstances, inasmuch as the infecting organism was relatively sensitive to penicillin *in vitro*, and satisfactory concentrations in the serum could readily be maintained. It is to be hoped that these encouraging results point the way to greater success.

[1] *The New England Journal of Medicine*, August 29, 1946.

Abstracts from Medical Literature.

SURGERY.

Pulmonary Œdema in Chest Wounds.

E. H. C. HARPER AND G. B. TAIT (*The Lancet*, April 13, 1946) state that pulmonary œdema is the most serious complication in large lacerating wounds of the lung. In spite of treatment with oxygen, atropine and hypertonic plasma, all their patients in whom this complication occurred died except one, who recovered after venesection. The authors utter a warning against the use of intravenous infusions in severe chest injuries, since they tend to produce pulmonary œdema.

An Accessory Instrument Tray.

BEATRICE H. AUFSES (*The Journal of Thoracic Surgery*, August, 1946) has devised and depicted a simple accessory tray to hold instruments during operations such as thoracoplasty, pneumonectomy, lobectomy, sympathectomy and nephrectomy, which are performed with the patient in the latericumbent position. During these operations instruments are often placed on the patient's hip and from there fall to the floor. The tray is made of stainless steel with rolled edges, and it is clamped to the patient's hip or thigh affording a flat surface. The clamps, made of specially tempered copper, are pliable, and therefore can be adjusted to fit adults of any size. The tray is placed under the sterile draping sheet, so that it need not be sterilized; but, if desired, it can be sterilized.

Ligation of the Inferior Vena Cava or Iliac Veins.

WILLIAM R. MOSES (*The New England Journal of Medicine*, July 4, 1946) discusses the indications for operative interruption of the iliac veins or the inferior *vena cava*, and reports his experiences with 36 cases. These procedures have grown in interest in relation to the prevention and treatment of pulmonary embolism. The author emphasizes that any method of treatment of phlebothrombosis is dependent on the diagnosis of its presence, and draws a parallel between phlebothrombosis and cancer in that the most significant stage of the disease occurs when the diagnosis is most obscure. The boundary between pure thrombophlebitis with relatively little danger of embolus, and phlebothrombosis with a clot which may readily become detached, is broad and vague. Anti-coagulants such as heparin and dicoumarol carry a threat of serious hæmorrhage, and the author has seen two deaths from their use. They probably do not affect clots already formed, and there is great uncertainty as to how long their administration should be continued. While appreciating the present state of flux in medical opinion regarding the entire problem of phlebothrombosis, the author has endeavoured to devise criteria on which the decision for ligation of the *vena cava* may be based. The indications tentatively accepted include thrombophlebitis of the pelvic veins with pulmonary emboli, pulmonary embolus associated with prostatic tenderness of recent or presumably recent origin; reasonably conclusive evidence of pulmonary infarcts, the source of which remains obscure; and venous occlusion of the lower extremities that would otherwise be treated by femoral vein ligation alone, but in which this is contraindicated, for example, by infection in the region of the femoral triangle. In the earlier stages of his study the author inclined towards iliac vein ligation in the therapy of apparently unilateral disease not manageable by the femoral approach, but now considers that the condition is so frequently bilateral that he prefers ligation of the *vena cava*, which is a simpler procedure than ligation of both iliac veins. To tie the *vena cava* the author uses a muscle-splitting incision in the right iliac fossa and approaches the vein by pushing the peritoneum medially. The latter is not opened and carries with it the ureter and internal gonadal vessels. In clearing the *vena cava* care must be taken to avoid tearing the lumbar veins. The entire operation is usually completed in fifteen minutes, spinal anæsthesia being preferred. Collateral venous return after caval ligature is adequate, and it has been stated that œdema of the legs is less than that which follows femoral ligation. The author's experience in this connexion has been that œdema has followed iliac or caval interruption only when there has been unequivocal evidence of persistence or recurrence of the original disease. The series of cases forming the basis of the report comprised fifteen ligations of iliac veins and twenty-one in which the inferior *vena cava* was tied. Abstracts are given of the histories of the thirteen patients who died following operation, and the essential data of the histories of those who survived operation are presented.

Penicillin-Pthalylsulphathiazole Antagonism.

EDGAR J. POTH, ROBERT I. WISE AND MARY P. SLATTERY (*Surgery*, July, 1946) report the results of an investigation into the simultaneous administration of penicillin and certain sulphonamides. The latter were succinylsulphathiazole and pthalylsulphathiazole, and each was given by the oral route to a series of patients with the idea of lowering the Gram-negative organisms and the anaerobic bacteria of the gastro-intestinal tract. It is known that the sulphonamides have little or no effect on the Gram-positive members of the intestinal flora, especially *Streptococcus fæcalis* and the Salmonella group. Penicillin has activity against some organisms not affected by the sulphonamides, but appears to be destroyed by penicillinase produced by the *Escherichia coli*. It was hoped by the investigators that when the coliform group had been reduced by the administration of the sulphonamides for some days, the systemic administration of penicillin would be effective against the remaining Gram-positive organisms. Succinylsulphathiazole and penicillin were used in this way without effect on the Gram-positives; then pthalylsulphathiazole and penicillin were tried with an unexpected result. When the penicillin was started there was again no effect on the Gram-positive inhabitants of the bowel, but the coliform organisms which had been depressed by the sulpha drug showed an abrupt and significant increase, although pthalylsulphathiazole was still being given. As soon as the penicillin was suspended the number of coliform organisms again fell. Anaerobic spores did not increase with penicillin, and in some cases were further reduced in number during its administration. The authors conclude that if it is desired to maintain a reduction of the coliform flora of the bowel, and at the same time to give penicillin, then pthalylsulphathiazole must not be used, and succinylsulphathiazole is the drug of choice; further, that the bacteriostatic action of these two sulphonamide drugs is not dependent entirely on their hydrolysis to sulphathiazole.

Total Resection of the Clavicle.

SIDNEY M. COPLAND (*The American Journal of Surgery*, August, 1946) reports two cases of total resection of the clavicle, and discusses briefly the indications for, and results of, this procedure. One patient had a pathological fracture due to metastatic carcinoma in the clavicle; the other had sustained a grossly comminuted fracture. Both patients were ambulatory within a few days, and free from pain within a week or two. The second patient, a policeman, is said to have resumed work three weeks after the operation, and to have suffered neither deformity nor interference with movement. The author disagrees with the popular view that the clavicle acts as a strut, and shares with Gurd the opinion that the bone serves no useful purpose apart from providing muscle attachments. Copland concludes that resection of the clavicle is indicated in pathological fractures, severe acromioclavicular separations, severe comminuted fractures with loss of substance, and possibly to afford better exposure to thoracic structures. Total resection of the clavicle is not a shocking operation and has a relatively short period of disability.

Resection of Left Lobe of Liver for Mesenchymoma.

EDWARD J. DONOVAN AND THOMAS V. SANTULLI (*Annals of Surgery*, July, 1946) report a case of removal of the left lobe of the liver. The patient was a boy of six years, in whom routine examination during an attack of coryza had led to the discovery of an epigastric mass. At laparotomy this was found to be cystic in nature. The liver was mobilized by cutting the falciform and left triangular ligaments, and the left lobe was removed, individual vessels being caught and tied as soon as they were divided. The cut surface was partly "oversown", the remainder being covered by (absorbable) oxidized cellulose gauze which was left in place, the abdomen being closed without drainage. Convalescence was uneventful and thirteen months later the boy appeared to be developing normally. After pathological examination the tumour was regarded as primary in nature and classified as a mesenchymoma.

Reconstruction of the Thumb.

PAUL W. GREELEY (*Annals of Surgery*, July, 1946) discusses the methods by which the thumb may be reconstructed, and reports ten cases in which this procedure was carried out by using a portion of the twelfth rib covered by a tube-pedicle flap of skin and subcutaneous fat. A hairless area in the flank is selected, and the tube is

fashioned and transferred to the thumb stump. After the tube has been severed from its abdominal attachment it is splinted to prevent angulation at the base and consequent circulatory obstruction. When the soft-parts graft has become well established, a suitable length of twelfth rib is removed and introduced into a tunnel made proximodistally in the tube, care being taken not to perforate the tip. The proximal end of the portion of rib is pointed and is driven into a socket prepared in the remnant of the first metacarpal bone; no other fixation is necessary. The bone graft is prepared with many drill holes to encourage vascularization. Union occurs in three to six months, and any redundant soft tissue is then trimmed away. This method of thumb reconstruction was found to give very satisfactory results. Movement at the carpo-metacarpal joint permits good opposition to the fingers, and the usefulness of the hand is greatly increased. All types of sensation except stereognosis develop in the skin flap.

Complete Duodenal Obstruction in the Newborn.

N. FREDERICK HICKON *et alii* (*The American Journal of Surgery*, April, 1946) present five cases of acute obstruction of the duodenum occurring in the newborn and discuss the causes, symptoms and treatment of this acute surgical emergency in infants. The intrinsic occlusions represent a failure of the duodenum to form a patulous lumen or a failure of total canalization. The extrinsic occlusions are due to external compression of a normally developed duodenum, generally by a failure of complete rotation of the midgut and faulty fixation of the small bowel mesentery. Vomiting is the cardinal symptom, and it begins shortly after the first feeding. As a rule, the occlusions lie below the ampulla of Vater, and the vomitus is stained with bile, while the meconium is acholic. Simple straight X-ray pictures may be of value in determining the level of the obstruction by demonstration of air bubbles, as long as an enema has not been administered. The use of opaque media is of value, but caution is needed because of the possibility of colonic distension which may embarrass respiration. The treatment is surgical, and in the main is of the nature of a posterior gastro-enterostomy or an ante-colic gastro-jejunostomy. Operation should be performed only when the frail infant has been thoroughly prepared according to physiological standards. The fluid and electrolytic balance must be changed from a negative to a positive phase. The anæsthetic used by the authors was cyclopropane supplemented where necessary by curare.

A Summary of Surgical Aspects of Certain Sulphonamides and Antibiotic Agents.

JOHN HENDERSON (*Surgery, Gynecology and Obstetrics*, July, 1946) summarizes in a collective review information in respect of sulphanilamide, sulphapyridine, sulphathiazole, sulphadiazine, sulphamerazine, succinylsulphathiazole, phthalylsulphathiazole, penicillin, streptomycin and tyrothricin. He points out that as so many circumstances govern any particular case, it is difficult to lay down a set of rules about the use of specific drugs in any given circumstance. However, in general, he advises that sulphonamides in pneumococcal and aerobic streptococcal systemic infections may be used except for gravely ill patients, for whom he prefers maximal doses of penicillin with or without a sulphonamide. In serious staphylococcal infections, penicillin should be used. Of the absorbable sulphonamides, the author prefers sulphadiazine or sulphamerazine, the latter being preferable in children because of smaller and less frequent dosage. In urinary tract infections, especially those due to susceptible strains of *Escherichia coli*, sulphadiazine appears to be the agent of choice unless streptomycin is available and the infecting bacterial system is susceptible to that antibiotic. In *lymphogranuloma venereum*, sulphadiazine is effective in early cases, but penicillin is contraindicated. In clostridial infections, penicillin must be used promptly and in maximal dosage together with antitoxin and definitive surgery. Reliance should not be placed on sulphonamides alone in this condition. For the pre-operative preparation of patients for intestinal surgery, succinylsulphathiazole is to be preferred, despite the mechanical drawback of the large number of tablets required for proper dosage. This drug gives an added factor of safety in all cases of operative appendicitis, in which peritonitis is of potential consequence. For certain infections of the intestinal tract, such as ulcerative colitis, ileitis and diverticulitis, phthalylsulphathiazole may be superior. For topical application, there seems little justification for the continued use of the sulphonamides. Tyrothricin is an excellent agent for this purpose, particularly for the irrigation of empyema cavities and the urinary bladder, since its activity is not decreased in the presence of purulent discharges. The local use of tyrothricin frequently may be combined advantageously with the systemic use of penicillin or the sulphonamides. Tyrothricin also is satisfactory for the treatment of vascular ulcers of the extremities, the preparation of infected areas for skin grafting, and the topical prophylaxis of Gram-positive wound infections.

Severe Fracture of the Os Calcis.

KENNETH H. PRIDIE (*Surgery, Gynecology and Obstetrics*, June, 1946) in a preliminary report describes a new method for the management of severe fractures of the *os calcis*, and presents briefly his experience of the method in fifteen cases. Modern warfare has increased both the incidence and the severity of fractures of the *os calcis*, and in those cases in which the subastragaloid joint is involved, the results are very disappointing. The author contends that when this complex joint surface is fractured and distorted, complete correction of displacement is impossible and a severe subastragaloid arthritis is inevitable. Böhler's method of reduction and early and late subastragaloid arthrodesis have all proved unsatisfactory in the author's hands, and he decided in 1942 to try the effect of total removal of the *os calcis*. This is done through a mid-line posterior and inferior incision. The plantar fascia is split longitudinally, and the *os calcis* is sawn in two along its only axis and shelled out so as to leave intact the periosteum and the fibres of the *tendo Achillis* which pass over the bone to become continuous with the plantar fascia. After closure of the wound, a pad is placed on each side of the heel to maintain its shape and a dressing is bandaged on. The foot is immobilized in plaster for one month in a position of plantar flexion, in order to relax the *tendo Achillis*. Active exercises are then commenced, and the patient is allowed to walk when he feels able to, usually about six weeks after the operation. The author's first two patients were treated two and three years previously, and both have had an excellent functional result. In two cases the results are described as bad. In one of these the patient was an elderly man with vascular disease and arthritis of the tarsal joints. The remaining patients are reported as having done exceptionally well.

Avulsion Injuries, Including Two Cases of Avulsion of the Scalp.

MARSHALL W. KELLY (*The American Journal of Surgery*, July, 1946) reports two cases of avulsion of the scalp in women in which he procured, prepared and resutured the scalp to the patients as a full thickness free graft. In both instances the police authorities were sent to retrieve the scalp from the factory where the accident occurred. The scalp was moistened with cool physiological saline solution and kept moist. Preparation of the scalp was first started by placing it over a bowl and shaving off the hair. Then it was inverted and all fat subcutaneous tissue was removed down to the derma. The scalp was then fitted onto the head and resutured. A similar method was used in two cases of avulsion of a finger tip and one in which skin had been avulsed from over the patella.

Metastatic Hypernephroma of the Thyreoid Gland.

R. R. LINTON *et alii* (*Surgery, Gynecology and Obstetrics*, October, 1946), in reporting a case of metastatic hypernephroma of the thyreoid gland, state that only fifteen cases have previously been reported. Two reasons have been advanced for the infrequency of the lodgement of metastases in the thyreoid. One is that the very rich arterial supply inhibits the lodgement of emboli in the gland; the other is that the rarity is due to chemical factors which hinder metastatic growth. The high oxygen and high iodine content of the gland may be factors which inhibit the development of malignant cells; in contrast, the relatively low oxygen saturation of liver tissue may predispose to the frequency of neoplastic spread to that organ. The authors' patient was a man, aged fifty-five years, who was admitted to hospital with a swelling in the neck of six months' duration. His left kidney had been removed nine years previously for hypernephroma; the right kidney was enlarged. He had no tremor, palpitation or increased prominence of the eyes. He had lost weight. The findings on blood examination were within normal limits. His systolic blood pressure was 116 and his diastolic pressure 70 millimetres of mercury. His basal metabolic rate was −3%. The blood cholesterol content was 140 milligrammes *per centum*. The gland was removed. The microscopic appearances were consistent with renal cell carcinoma. The right kidney contained a hypernephroma which was regarded as a metastasis from the original lesion in the left kidney.

British Medical Association News.

SCIENTIFIC.

A MEETING of the South Australian Branch of the British Medical Association was held on August 29, 1946, at the Verco Theatre, Institute of Medical and Veterinary Science, Adelaide; Dr. L. R. MALLEN, the President, was in the chair at the beginning of the meeting, and DR. JOHN MAYO took the chair later. The meeting took the form of a number of ten-minute talks and demonstrations by members of the Radiological Section of the Branch.

Carcinoma of the Œsophagus.

DR. B. S. HANSON discussed carcinoma of the œsophagus. He said that it might be asked why, with the whole field of radiology to choose from, he should select this melancholy subject for his talk; he had nothing new to offer and no good results to show—indeed, his patients were all dead. His reasons were twofold. First, for the past two years he had been interested in trying to improve his technique with this disease, and secondly, he had recently examined a patient who earlier this year was diagnosed as suffering from carcinoma of the œsophagus and advised to have a gastrostomy performed, and was told that no other treatment was of any avail. The fact that he was later diagnosed as suffering from cardiospasm was beside the question; the point Dr. Hanson wished to make was that worthwhile palliative treatment was practicable by one of several methods. The rationale of therapy depended upon several aspects of malignant disease of the œsophagus, and it seemed desirable to touch on one or two of these points before going on to consider the method of treatment to be employed.

Morbid Anatomy.

Dr. Hanson went on to say that he had encountered one case of lymphosarcoma involving the œsophageal wall and causing obstruction; but malignant disease of the œsophagus was so predominantly carcinoma that for all practical purposes only carcinoma needed to be considered. Some seventy patients suffering from carcinoma of the œsophagus had been examined at the radium department of the Royal Adelaide Hospital during the past sixteen years. From the viewpoint of therapy they were divisible into so many groups that in not one of them was the number sufficient to warrant examination of the results. They served, however, to confirm certain experiences in other centres. They showed that carcinoma was usually squamous or transitional in type; it was rarely adenocarcinoma, and rarely scirrhous in form. Carcinoma at the inferior extremity was nearly always adenocarcinoma which had extended up from the stomach. Leucoplakia was often detected through the œsophagoscope and in biopsy material in the neighbourhood of newgrowth, and it might be presumed that this condition was present in a number of instances before the growth had developed, just as was the case in the buccal mucous membrane. An ulcer was one of the earliest local signs, and it tended fairly quickly to encircle the lumen of the tube. In the earlier stages spasm resulting from irritation of the ulcer caused some obstruction, while later infiltration and fungation made the obstruction more constant and severe. The scirrhous type did not fungate and tended to form as a gradual process. As the obstruction increased in degree, mucoid secretion from the glands in the wall of the œsophagus increased in quantity, and with swallowed saliva formed pools above the obstruction. There was a tendency towards local spread, with invasion of the great vessels and the tracheo-bronchial tree, and a sudden massive hæmorrhage was a not uncommon cause of death. The diet had always been progressively restricted, so that malnutrition was an almost constant finding, and it was this, together with the local mass, which caused the death of untreated patients rather than distant metastases. Lymphatic extension occurred in the axis of the œsophagus and eventually to the posterior mediastinal glands and later to other structures.

Diagnosis.

Discussing diagnosis, Dr. Hanson said that the patient presented himself with a history of chronic dysphagia, which was sometimes intermittent at first, but which gradually increased in constancy and severity. It was of discomfort following eating that he complained, rather than of pain such as occurred with an inflammatory or peptic ulcer. Mucoid regurgitation into the mouth was a late sign, and in the case of a thin, elderly patient with chronic dysphagia it was almost pathognomonic of newgrowth with obstruction. The main diagnostic procedures were X-ray examination with a barium bolus, and examination through the œsophagoscope. A number of causes of dysphagia by pressure from outside the gullet might be recalled—pressure from a mass, or obstructive angulation from adhesions in mediastinal or pulmonary fibrosis; under the former heading might be mentioned pharyngeal pouch. Within the organ the principal differential diagnosis from the X-ray point of view, congenital anomalies excluded, was concerned with the non-obstructive lesions (diverticulum and varices) and the obstructive lesions (cardiospasm, simple traumatic stricture and ulceration with spasm). Varices caused a ragged filling defect, but unless they were secondarily ulcerated they were relatively pliable, and this served to distinguish them from the more rigid mucosal destruction of newgrowth. Dr. Hanson said that he had seen peptic ulcer of the œsophagus in several cases, but only in association with a partial thoracic stomach, in which the patulous cardiac orifice more readily allowed reflux of the gastric juice; it was said to occur in other cases. In the earlier stage the rapid, writhing movements of the irritated œsophageal wall, seen for some distance above and below the ulcer after a barium bolus, were characteristic and distinguished the ulcer crater from the diverticulum, in which there was no irritability and in which the pattern of the neighbouring mucous membrane was undisturbed. At a later stage, when fibrosis had occurred, it was extremely difficult to distinguish without periodic examinations between simple ulceration and newgrowth. Cardiospasm, of course, affected only the terminal portion of the œsophagus, and there was usually wide dilatation above the constricted portion, perhaps with retained food remnants causing the barium to throw a patchy shadow not unlike that produced by the presence of a tumour. In some cases the spasm relaxed quickly after inhalation of amyl nitrite; but the important feature was the relatively smooth tapering of the œsophagus, and the fact that a good X-ray film might reveal a few thin lines of undisturbed mucous membrane passing through the constriction. Simple spasm similarly showed a smooth outline; but this did not necessarily exclude the scirrhous form of carcinoma, or, of course, early carcinoma associated with spasm. A ragged filling defect, especially if it was associated with a visible mass projecting into the posterior part of the mediastinum, was diagnostic of newgrowth; but in all other cases of constant diminution of the lumen Dr. Hanson believed that an œsophagoscope should be passed, the lesion should be inspected, and whenever possible a biopsy should be obtained. This manœuvre was not only important in establishing the diagnosis, but was also important in determining the form of treatment to adopt.

Treatment.

Dr. Hanson then referred to treatment. He said that the three forms of treatment to be considered, other than gastrostomy, were (i) surgical removal, (ii) insertion of a Souttar's tube, and (iii) irradiation. In the hands of Grey Turner surgical removal had been productive of one or two cures. In his operation he divided the œsophagus above and below and freed it as far as he could reach, and then pulled on it and removed it as one would the œsophagus from a decapitated fowl. Dr. Hanson thought that a most drastic procedure, and one which could possibly be successful only in the earliest cases, and except in the hands of the most highly specialized surgeon it did not appear a practicable method to be considered. The insertion of a Souttar's tube, which was made of coiled gold wire with a broad upper end to prevent it from sliding right through the stricture, was often productive of considerable palliation, in that after its insertion the patient was able to eat a fairly varied diet, and his malnutrition might thereby be quickly relieved. It had no effect on the progress of the disease otherwise, and suffered from the defects that at times it was apt to be blocked by other than fluids and the finest of minced food, and it tended to ulcerate through the stricture and enter the stomach. Dr. Hanson believed that when it could be used, the palliation it afforded was better than that achieved by gastrostomy; in both cases the malnutrition was relieved, but in the latter case unæsthetic feeding was necessary through a tube in the abdomen, which could not compare in the patient's mind with feeding through the mouth in the normal way.

Discussing irradiation therapy, Dr. Hanson said that before the recent war there were one or two claims from German clinics for cure of carcinoma of the œsophagus following irradiation therapy, and Smithers, of London, had at present one or two patients who were symptom-free four years after treatment. However, such claims were so rare as to be curiosities with the present methods of treatment, and the most that was usually aimed at was a worthwhile degree of palliation. The science of irradiation therapy had now

reached a stage at which it should not be said that this or that disease was not amenable to irradiation treatment because patient A was not cured by it; rather should it be said, as was so often the case with surgery, that in the form in which it was applied irradiation was not effective, for there were many possible forms in which this treatment might be administered. Such a distinction applied especially to carcinoma of the œsophagus, and to understand the rationale of treatment it was well to emphasize several basic points. First of all, the intensity of the irradiation varied inversely as the square of the distance from the radioactive source. Dr. Hanson instanced the case of a radium tube suspended in a newgrowth which had caused so little constriction that it was possible by employing a thick rubber tube to pack the radium a quarter of an inch away from the whole circumference of the œsophageal wall. The optimum dose at the surface of the growth was practically the maximum dose that the œsophageal mucous membrane would stand without permanent destruction, and this might be calculated readily enough. But the growth might easily be one inch thick, and at the deepest part of it in such a case the effective γ irradiation was only one twenty-fifth of that on the surface of the lesion. The deep extension thus could not be destroyed, and it might be said, therefore, that surface radium treatment applied within the œsophageal lumen would not cure any but the earliest carcinoma, and in a narrower stricture, where the radium must lie closer to the surface, this disparity between surface dose and deep dose became even greater. Insertion of needles into the wall of the œsophagus through an œsophagoscope was at best an uncertain method, and while the implantation of needles around the œsophagus in a transthoracic approach offered better physical possibilities of even irradiation, any practical exposure of the affected segment of the œsophagus proved difficult to obtain. In the case of deep X-ray treatment, on the other hand, the tube would be placed at least two feet from the œsophagus, and the difference in dose received at the depth of the tumour and on its surface would then be in the ratio of 24^2 to 23^2, or in other words, the difference was negligible. This even distribution of dose gave X-ray therapy an advantage over radium, and indicated that deep X rays should be the primary form of radiation treatment in this disease.

Dr. Hanson went on to say that another important element was the fact that normal lung tissue was relatively sensitive to X rays, in so far as fibrosis would occur after a dose which would readily be tolerated by the skin, for example. In order to minimize the dose received by the lung tissue, in some European clinics the patient was so seated on a revolving chair that his œsophagus was in the axis of rotation of the chair, and he was slowly rotated in front of the X-ray tube as though on a spit. By this means the necessary dose was spread through a large volume of the lung, and the irradiation might be compared to the spokes of a wheel, which were concentrated at the axle, but although the same in number, were widely dispersed at the periphery. It would be difficult indeed to ensure that a tumour was in fact in the axis of rotation, and in any case, such apparatus was not available in Australia. The usual means of avoiding overdosage of the lung was to irradiate the œsophagus mainly through the anterior and posterior portions of the mediastinum. Multiple fields, each passing through the tumour, had to be used, in order that the skin, which was so much closer to the X-ray tube than the œsophagus and therefore received so much higher a dose, did not break down as a result.

Dr. Hanson then said that the third basic factor to be considered was that general depressing irradiation effects were to a large extent dependent on the volume of tissue irradiated. It was necessary that a good length of the œsophagus above and below the growth should be included in the field in order to deal effectively with local lymphatic permeation, and at the same time it was necessary to limit the width of the field to a size which would just include the malignant tissue, if they were to avoid both excessive irradiation of the lung and irradiation of so large a volume of tissue as to cause X-ray sickness. The narrow beam that was used introduced the possibility of missing the lesion altogether unless some aiming device was employed. In practice it sufficed to examine the patient under the X-ray screen, and to mark with metal markers and subsequently some form of paint the points of entrance and emittance of at least six beams, each of which would pass through the tumour. Each time the patient was set up against the treatment plant, once or twice a day as required, it was possible to ensure that the rays passed through the growth and that the treatment was effective. In lesions of the lower part of the œsophagus the distance from the skin was so great that it was not possible to give as large a dose into the tumour as was desired without seriously damaging the neighbouring tissues, and in practice it had been found necessary to use a small supplementary dose of radium suspended within the lesion. The course of X-ray therapy took from four to six weeks to administer, and by the end of that period usually the growth had resolved sufficiently to permit the easy suspension of a radium tube within a rubber tube inside the involved portion of the lumen.

Dr. Hanson went on to say that in 1931 Dr. I. B. Jose had investigated cases of untreated carcinoma of the œsophagus at the Adelaide Hospital, and he had concluded that the length of life after the diagnosis was made averaged about two and a half months. He also found that the length of life of similar patients after irradiation therapy was prolonged to a slight extent. Considerable advances had been made in irradiation therapy since that time, and the prolongation of life was certainly greater in 1946 than it had been in 1931. For example, five patients treated with irradiation in the first half of 1931 lived for about three months after the first treatment was given, while the last five patients treated in 1945 and 1946 lived on an average seven months after treatment. A few more months of life was not necessarily palliation; but these later people not only lived longer, but were also able to swallow reasonably well, and at least for a time improved in general health, while it was in most cases distant metastases which ended life rather than the primary lesion. Adenocarcinoma of the stomach was to all intents and purposes radio-resistant, and if biopsy showed this condition to be present, Dr. Hanson believed that irradiation was contraindicated, and insertion of a Souttar's tube, if practicable, offered the best method of temporary palliation. However, in his opinion other patients should be given the benefit of a course of irradiation therapy, primarily deep X ray in type, with subsidiary radium treatment when necessary. This treatment should not be combined with insertion of a Souttar's tube, for the tube itself acted as a highly efficient local filter, which protected most of the growth from the effect of the rays and made impossible the calculation of the dose actually received by the tumour. Some resolution of the fungating mass was usually achieved quickly enough to obviate the necessity for gastrostomy. Admittedly if this was to be performed at all, it should be performed early; but in Dr. Hanson's opinion it should rarely be requested. In all cases the nutritional defect had to be treated, and Dr. Hanson believed that a vitamin-rich diet in liquid form, and possibly a blood transfusion, were necessary preliminaries to the radiation course, and administration of vitamins should continue throughout the course of treatment and after it was completed. The patient had temporary soreness on swallowing lasting two to four weeks after completion of the treatment, but in Dr. Hanson's experience this was not sufficient to deter him from taking a reasonable diet, and his weight began to increase fairly soon after the course was finished and his mental outlook improved accordingly. Dr. Margaret Tod, of the Manchester irradiation therapy school, had made the trite but sensible remark that to be effective palliation treatment must palliate. Dr. Hanson said that in his opinion irradiation therapy in carcinoma of the œsophagus, tedious though it was for doctor and patient alike, was able to comply with this requirement.

(To be continued.)

Naval, Military and Air Force.

APPOINTMENTS.

THE undermentioned appointments, changes *et cetera* have been promulgated in the *Commonwealth of Australia Gazette*, Number 225, of November 28, 1946.

PERMANENT NAVAL FORCES OF THE COMMONWEALTH (SEA-GOING FORCES).

Promotion.—Surgeon Lieutenant-Commander (Acting Surgeon Commander) Godfrey Joseph Kelleher Lane is promoted to the rank of Surgeon Commander, dated 30th September, 1946.

Honorary Physician and Honorary Surgeon.—Surgeon Commanders James Martin Flattery, O.B.E., and Charles Anthony Downward, D.S.C., are appointed Honorary Physician and Honorary Surgeon respectively to His Royal Highness the Governor-General, dated 18th July, 1946; the appointments of Surgeon Captain Denis Adrian Pritchard and Surgeon Commander (Acting Surgeon Captain) Lionel

Lockwood, M.V.O., D.S.C., as Honorary Physician and Honorary Surgeon respectively to His Royal Highness the Governor-General are terminated, dated 17th July, 1946.

AUSTRALIAN MILITARY FORCES.

Australian Army Medical Corps.

VX94238 Captain (Temporary Major) F. P. Callaghan relinquishes the rank of Temporary Major, 12th September, 1946.

QX6437 Lieutenant-Colonel (Temporary Colonel) A. W. L. Row relinquishes the rank of Temporary Colonel and is transferred to the Reserve of Officers (Australian Army Medical Corps), 30th August, 1946.

VX138651 Lieutenant-Colonel (Temporary Colonel) J. H. Anderson, C.M.G., C.B.E., relinquishes the rank of Temporary Colonel and is placed upon the Retired List with the honorary rank of Colonel with permission to wear the prescribed uniform, 23rd March, 1946.

Reserve of Officers.

The undermentioned officers are transferred to the Reserve of Officers with effect from the dates indicated, and on the date prior to such transfer, where applicable, cease to be seconded. Officers holding temporary rank relinquish such temporary rank on the date of transfer to the Reserve of Officers:

Captains QX64242 R. F. J. Wood, 22nd August, 1946, and NX126922 W. W. McLaren, 27th August, 1946.

106*th Australian General Hospital.*—VX94641 Captain J. C. F. Minnis, 28th August, 1946.

No. 112 (*Brisbane*) *Military Hospital.*—QX62368 Captain P. R. Patrick, 21st August, 1946.

50*th Australian Camp Hospital.*—V511980 Captain N. B. Cohen, 30th August, 1946.

80*th Australian Camp Hospital.*—TX6481 Captain K. W. Bretherton, 3rd September, 1946.

Inter-Service Medical Wing Demobilization Centres (*Australian Military Forces Component*).—Captains NX77249 G. M. Brodie, 22nd August, 1946, NX202239 D. A. Ferguson, 27th August, 1946, NX148284 A. L. Hellestrand, 30th August, 1946, NX201399 L. T. Robey, 27th August, 1946, and TX6480 H. T. Tisdall, 1st May, 1946.

The undermentioned officers are transferred to the Reserve of Officers with effect from the dates indicated, and on the date prior to such transfer, where applicable, cease to be seconded. Officers holding temporary rank relinquish such temporary rank on the date of transfer to the Reserve of Officers and are granted from such date honorary rank of the Reserve of Officers equivalent to the temporary rank relinquished:

NX76368 Captain (Temporary Major) S. G. Mallarky, 27th August, 1946.

No. 113 (*Concord*) *Military Hospital.*—NX172929 Captain (Temporary Major) J. M. Garvan, 23rd August, 1946.

Retired List.

The undermentioned officer is placed upon the Retired List on the date indicated with permission to retain the present substantive rank and wear the prescribed uniform:

Permanent Supernumerary List.—NX71022 Captain D. J. Brennan, 27th August, 1946.

ROYAL AUSTRALIAN AIR FORCE.

Citizen Air Force: Medical Branch.

The appointments of the following officers are terminated on demobilization with effect from the dates indicated: Temporary Squadron Leader R. C. Willis (253219), 30th September, 1946, (Flight Lieutenants) D. Hemming-Jones (277460), 17th September, 1946, W. P. McDonogh (267694), 2nd October, 1946, W. J. Barrett (267742), 8th October, 1946, G. A. Levinson (297422), P. W. Read (257475), 9th October, 1946, D. B. Duffy (256830), 10th October, 1946, Temporary Squadron Leader P. A. Foley (253725), Flight Lieutenant, Acting Squadron Leader W. A. Leventhal (263409), 14th October, 1946, (Flight Lieutenants) H. Seamonds (267692), 9th October, 1946, N. Kerkenezov (267618), 10th October, 1946, W. M. C. Keane (257559), B. V. Mutton (267570), 17th October, 1946, K. W. MacLeod (263453), 6th September, 1946, R. J. Rutherford (267533), 24th October, 1946, E. W. Gibson (266785), 28th October, 1946, K. H. Sisson (257576), 30th October, 1946, B. N. Ostberg (257582), 1st November, 1946.

Reserve: Medical Branch.

The following officers are appointed to commissions with ranks as shown with effect from 1st November, 1946: (Temporary Wing Commanders) Ian Harry Cuming (251214), Frank Fairfax Ellis (261200), Victor Ernest Knight (251197), Jack Charles Laver (251199), Henry David Phipps (251243), Stanley Francis Reid, O.B.E. (251174), Kenneth Edward Rex (251245), (Temporary Squadron Leaders) John William Lee Atkinson (251414), Ian Reynolds Barrie (263252), John Strahan Bothroyd (251461), John Sanday Burgess (261372), John Halliday Coto (252749), Geoffrey Wyndham Davies (261505), William Deane-Butcher (261286), John Richard Fountayne England (283727), Sydney Bayley Forgan (281237), Robert Chalmers Gill (261482), Donald Graham Hamilton (263719), Joseph Anthony Horan (252570), James Isbister (261691), William Geoffrey Jasper (263897), Trevor William Jenkins (252867), Dudley Owen Longmuir (253239), Robert Gordon Mackay (261769), William Peter McLaughlin (261770), William Brien Marsh (261768), Bryan Willis Monahan (261612), Stuart MacKenzie Morson (262063), Barry Joseph Mulvany (251258), Leonard James Thomas Murphy (251208), Alan Harry Penington (251211), Francis William Perrottet (262723), Bruce Carlyle Pirie (262084), Herbert James Prior (261290), Edward Donough Mulvihill Ryan (253343), William Thomas Hudson Scales (263240), John Nelson Sevier (263442), William Hamilton Smith (253443), Arthur George Rongo Uglow (251196), Travis Wilhelm Vorrath (252750), Stephen Douglas Watsford (253263), Howard Mansfield Webber (261893), Rory Clevedon Willis (253219), Geoffrey Campbell Wilson (251265), Sidney Fergus McRae Yeates (272046), Joseph Francis Ziegler (257480), (Flight Lieutenants) Michael Barry (267236), Donald Fergus Buckle (263865), Maurice Vivian Clarke (253717), Leslie Charles George Colville (256713), Lloyd Angus Commins (264588), Leslie Critchley Dunlop (267739), Henry Rupert Hawkins (251777), John Howie Isles (273437), Henry Hollister Jackson (251379), Orme Kaye Kewish (256693), Francis Winston Kiel (253233), Gordon Alfred Levinson (297422), William Alexander Leventhal (263409), Arthur James Lundie (263436), Charles Francis McCann (257631), William Patrick McDonogh (267694), John Hilton Newton (263890), Earle Fead Northcroft (266734), Edward Donough Ernest Eugene O'Brien (257096), Richard Cunninghame Opie (263435), Russell Hughes Oxby-Donald (255253), George Andrew Robbie (256865), Ronald James Rutherford (267533), James Hamilton Smith (253338), Grantley Sheridan Stable (277461), William John Stevenson (257483), Verner William Threlkeld (256829), Charles Rolleston Watson (266788), Charles Ronald Wherrett (267599), George Whyte (267598), Archibald Binnie Yuille (267346).—(Ex. Min. No. 277—Approved 27th November, 1946.

Special Correspondence.

LONDON LETTER.

FROM OUR SPECIAL REPRESENTATIVE.

THE plebiscite is the main topic of medical interest at the moment, and letters about it have strayed from the purely medical to the lay Press. For many years doctors as a class have not been satisfied with the distribution of medical facilities in this country, as is exemplified by the aphorism that only the very rich and the very poor get the best of medical and surgical attention—the former from men at the top of the tree in expensive nursing homes, and the latter in the big general hospitals at the hands of the same men, acting in an honorary capacity. Lectures have been given, committees (one of the best known is the Medical Planning Committee) have met and presented reports, discussions have been held, and letters have been written to both medical and lay Press, all without any tangible result. But all the time the ferment was working, though well out of sight and possibly out of the thoughts of most people. Some years ago a committee, later known as the Negotiating Committee, was set up, members of which were drawn from the three English Colleges, the British Medical Association, the Scottish Corporations, the Society of Medical Officers of Health, the Medical Women's Federation, the Association of Non-Teaching Voluntary Hospitals and the Society of Apothecaries. It was a good committee and its terms of reference were to confer with any Minister of Health who might be considering the introduction of a bill into Parliament and to watch the passage of such bill till it should become an act on the Statute Book. The Negotiating Committee began with Mr. Ernest Brown, and later with Mr. H. Willink had almost completed the details of a bill when the Coalition Government fell and Labour took over power. The new Minister of Health,

Mr. Aneurin Bevan, not to be confused with Mr. Ernest Bevin, the Foreign Secretary, was not nearly as sympathetic to the views of the doctors as had been his predecessors. This is not to be wondered at, as a full-time medical service is a plank in Labour policy. The doctors regard such a plan as nationalization pure and simple, and for the greater part do not favour it. From time to time details of the negotiations have leaked out, and it would appear that the Minister and the Negotiating Committee attached a different meaning to the word "discuss". As one man described it, it was a case of "what I say is what goes", and the doctors' representatives were not the people who did the talking that was translated later into action. The Negotiating Committee circulated a short statement setting ou what came to be called the "seven principles" which they regarded as the basis of a medical service for the nation, from the professional viewpoint. These principles were discussed and confirmed by meetings of practitioners held up and down the country. In July, 1946, the Annual Representative Meeting (which Dr. John Hunter, of Sydney, attended) decided by overwhelming majorities in favour of no direction of doctors as to where they should practise (241 to 12), in favour of a doctor retaining the goodwill of his practice (229 to 13), in favour of payment by capitation fee rather than by salary (209 to 8), and against State ownership of hospitals (210 to 29). These decisions became known as the "resolutions". When the National Health Services Bill became an act a few weeks ago, it showed a wide divergence from, even if it was not in direct opposition to, both the principles and the resolutions.

The act is only the framework within which the new health service will function, and many points, both of procedure and otherwise, will have to be worked out. This will be done by regulation or order promulgated by the Minister, and doctors are vitally interested in many of such regulations and orders. The instructions to the Negotiating Committee lapsed when the bill became an act, and they have asked if they are to continue discussions or not. The British Medical Association felt that the matter was one on which the whole of the profession should be consulted, especially as the Council was bound by a resolution of the Representative Body to do so. The result is that some 58,000 ballot papers have been sent out to doctors at home and overseas, asking for an answer to the question: "Do you desire the Negotiating Committee to enter into discussions with the Minister on the regulations authorised by the National Health Service Act. Please answer YES or NO." The ballot is a secret one, and as soon as the issue is settled the papers will be destroyed.

A "yes" vote does not involve a decision to enter the new service later. It means that the voter thinks that discussions should continue with the Minister, so that he may be made aware of the profession's views on the numerous important questions which are to be covered by regulations and orders. A random sampling shows that such matters as (*a*) qualifications, rates of pay, conditions of service of officers, (*b*) arrangements for the use of health centres by doctors, (*c*) the procedure of the tribunal dealing with the disqualification of a doctor and (*d*) the appointment of medical staffs of hospitals, will be dealt with by regulation. As stated above, doctors are closely concerned with these and kindred matters.

While there is no obligation as to future action on the part of those who vote "yes", the case is different for those general practitioners and members of visiting hospital staffs who vote "no". In their case a negative vote is taken as a pledge not to enter the new service, if so advised by the British Medical Association. The words "if so advised" were put in to cover men who held certain appointments such as those of medical officers of health to local authorities. Such a man can vote "no" with the knowledge that he will not be asked to resign his office, should matters come to a "showdown". Special consideration has been given to men getting on towards middle life, with heavy educational commitments for their children, and for young men just beginning practice, who through war service have lost years of work when they might have been earning. A committee has been set up to consider such cases of hardship, and the chairman of the Council has stated, from the financial side, that "we could tomorrow spend up to a million pounds".

The main argument for voting "no" may be stated as follows. "The Act is contrary to the principles and resolutions already adopted, it is also the first step towards setting up a full-time State medical service, and as such the profession should have nothing to do with it. If the end is wrong, why waste time to attain that end, especially as the Minister has not in the past shown himself very amenable to the usual procedure of discussions."

Those who propose to vote "yes" contend: "It is not logical or reasonable to give a final decision till the whole scheme is known in all its details. This cannot be till the regulations and orders have been decided. If no negotiations are held the Minister cannot know what are the views of the profession on such regulations and orders. Even if we vote 'yes' now it does not mean we are willing to enter the new service, we will decide this point later on when we know all the facts. Refusal to negotiate will put the profession in a bad light in the eyes of the public, for they will think that we have not done all that we could to improve the Act and also that we have been guilty of making a decision before knowing what we were deciding about."

So run the two lines of thought, and the ballot will show what the profession really does think.

In addition to his "yes" or "no" on the question of future discussions, each voter is asked to state the number of years since qualification, and his main sphere of work—for example, consultant, general practitioner, whole-time appointment (hospital and type of hospital, public health, government, teacher or research), retired or unclassified with four special categories for people in the services.

Above all, each practitioner is urged to vote, "whatever his views". It is impossible to forecast the result, but from the letters appearing it would seem that those closely connected with hospital or whole-time teaching jobs rather tend to favour the continuance of discussions. This may be because the subject matter in which they are interested is less contentious, and because there is so much detail, and such important detail, regarding these institutions still to be settled and on which expert advice is so necessary. The most important sectional vote will be that of the general practitioner, for without his full concurrence the act cannot be worked. As a rule he does not write freely to the papers, nor does he speak much at meetings, and so it is not easy to know what he is thinking or how he is voting. One thing he does remember is that direct action carried the day recently in the matter of the Spens report and the capitation fee. Voters have been asked to return their papers by the end of the month if possible, with an extension of time for men overseas, and it is hoped to give a preliminary result before the middle of December.

With an English cricket team in Australia more people than usual are taking an interest in the early morning news service provided by the British Broadcasting Corporation. Up to now, scores of the matches played against the various State teams have been broadcast a few minutes after 8 a.m. each morning, and on a dull, murky November day, with rain beating against the window, as has been the custom lately, it is tantalizing to hear what has been taking place in Brisbane "in glorious sunshine". With the test matches we are to get a much better service, for from 7 a.m. to 8 a.m. a ball-by-ball commentary will be given describing the last part of the day's play. Happy then is the man who owns a portable set that he can carry with him from bed to bath and so to breakfast, with perhaps a kitchen interlude on the way, for there are few who do not find some household or domestic chores demanding attention between getting out of bed and setting off to work. Dealing with unresponsive kitchen ranges and washing up are both regarded as needing the strong hand of the male to produce the best results. The British Broadcasting Corporation, by means of its special observers on the spot, treats us to short eye-witness accounts of all sorts of overseas events, such as meetings of the United Nations, debates in the Senate of the United States of America, elections in Paris and the like; but it is rather typical that test matches should be given special attention on the air, to the dislocation of the usual programme, and so rank with the coronation and the burial of our kings, peace celebrations after a great war or a royal visit to the city of London on some momentous occasion—in short, be treated as a national event, with a widespread appeal.

Correspondence.

THE ZOOLOGICAL POSITION OF MAN.

SIR: In Dr. Burkitt's paper, "The Zoological Position of Man", published in your issue of November 2, there are some points on which I should like to offer comment:

1. The title is misleading, for the paper says very little about the relation of man to other animal forms or about the evolutionary process which resulted in the production of the human form.

2. Not everyone will accept his appraisal of J. S. Huxley's "Evolution, the Modern Synthesis" as a "masterly synthesis",

for although the book contains a vast assortment of biological information, it lacks the breadth of view required for a genuine synthesis; for example, Huxley ignores the principal problems that confront the evolutionary theorist, devoting the greater part of his book to a discussion of the origin of species, even though, as he admits on page 411, "the origin of species is largely irrelevant to the large-scale movements of evolution".

3. Dobzhansky's definitions of species and race are unsatisfactory because they suppose the truth of the gene theory, whereas a good definition will give expression to facts. Goldschmidt writes: "The classical atomistic theory of the gene is not indispensable, for genetics as well as evolution. It is this theory which blocks progress in evolutionary thought. . . . We have already foreshadowed the twilight of the gene" (The Material Basis of Evolution, 1940, pages 209-210). And the same writer remarks that "the oldest conception of species, and the one which has not yet been replaced, states that the decisive differences between species of animals are sterility of hybrids between species and the more or less complete physiological isolation preventing hybridization" (*ibidem*, page 114).

4. If Neanderthal man and modern man at one period "could interbreed and were races of the same species", there seems to be little justification for the view that *Homo erectus*, *Homo intermedius* (Neanderthal) and *Homo sapiens* are "three successive species". It is far more probable that they are three races of the one species, since they do not differ more than the wolfhound, bulldog and King Charles spaniel, which are certainly members of one species.

5. What are "the evidences found in steadily increasing number" of "the acquisition of conceptual thought" and "the development of speech"? Or rather, does Dr. Burkitt mean that we have evidence of a steady increase in conceptual thought, or simply that these evidences become steadily more numerous, for example, because of the steady increase in human population and the consequent wider dispersal of human remains with tools *et cetera*?

6. Dr. Burkitt speaks of the "progressive enlargement of the brain". But is not the average Neanderthal brain larger than the average modern brain?

7. The explanation which Dr. Burkitt offers for the great variability of the human type rests on the assumption that species arise through the isolation of the subspecific groups. Goldschmidt, in the work already quoted, argues very convincingly against this assumption.

8. It is extremely doubtful whether Dryopithecus is, as Dr. Burkitt affirms, an ancestor of man; for one thing, only the jawbone of Dryopithecus has been preserved, and even allowing its full weight to the Cuvierian principle of correlation, this seems an inadequate basis for the reconstruction of an animal type.

9. By introducing the concepts of "genic balance" or "gene complex" the geneticists have tacitly abandoned the classical theory of the gene, for this is an admission that the genotype cannot be truly represented as a collection of genes, but only as an organic unit, a pattern, which is more important than the particulate elements of which it is composed.

10. How on earth does J. S. Huxley know that "a brain capable of conceptual thought could not have been developed elsewhere than in a human body"? Does he pretend to an exhaustive knowledge of the possibilities of organic life? Moreover, the majority of philosophers deny that the brain is capable of conceptual thought. Aristotle, for example, admits that conceptual thought and the brain are closely connected, but he denies that the brain itself produces thought.

11. Is the "intra-uterine competition", of which Huxley speaks, a fact? And if it is a fact, does it increase the speed of development? Do twins develop faster in the womb than single embryos?

12. The theory that man has evolved from an arboreal ancestor is pure a priori speculation. Hooton, of Harvard, has criticized it sharply.

13. Dr. Burkitt declares that the future of physical anthropology lies rather in genetic studies than in observation and measurement of living man and of skeletal material. But surely the genes can be known only by the study of their phenotypical effects, which are the objects of observation and measurement.

14. The statistical methods of Pearson, Haldane, Fisher and others have their place in anthropological research, but it is a minor place. As Goldschmidt remarks, "the most brilliant mathematical treatment is in vain if the biological rating of the material is not correct".

15. Man is said to be "continuously sexed". Is this not the case also for the monkey and the donkey?

16. Dr. Burkitt says that it is not certain whether man possesses the power of extrasensory perception. On the contrary, thanks to the experiments of Rhine and others, it is quite certain that man does possess this power, although the manner of its operation is unknown. Finally, not everyone will agree that it is desirable that control of the destiny of mankind should be effected by the means at the disposal of the physical anthropologist.

Yours, etc.,

"CRITICUS".

SOME PROBLEMS OF VARICOSE VEINS.

SIR: May I make some observations on the article by Dr. C. H. Wickham Lawes entitled "Some Problems of Varicose Veins", which appeared in the journal of November 16, 1946? Dr. Lawes has done well to stimulate interest in this subject, and to emphasize the need for attention to detail in diagnosis and management. His statement that "most bad results [of treatment] are the result of bad technique" will find wide acceptance.

The chief purpose of this letter is to comment on the very interesting problem of the patient with varicose veins and a history of previous thrombosis in the deep veins of the leg. I write in no spirit of criticism, but in the hope that further discussion may be provoked and some light thrown on this condition.

Dr. Lawes states:

> Compensatory veins, that is, enlarged superficial veins in a patient with a past history of deep vein thrombosis, present a problem. The accepted teaching has always been that they should not be touched, as unfortunate results have followed their obliteration. I have, however, seen a patient with obliteration of the deep veins and a history of earlier femoral thrombosis, who had a thrombophlebitis of the whole length of the long saphenous vein without ill effects.

To my mind, this paragraph does not set the matter forth as clearly as is necessary to permit logical analysis.

If enlarged superficial veins are compensatory and if the deep veins are no longer patent, then no one would question the impropriety of seeking to obliterate the former. If, however, the deep veins are patent, and the superficial veins are varicose, then the valves in the latter are presumably incompetent, and blood flow within them is directed towards the feet, at any rate while the patient is in the erect posture. Under such conditions the superficial veins are in no sense compensatory, but are actually adding to the burden of the deep veins by allowing blood to spill "backwards" down the limb—blood which must eventually ascend by the deep system, increasing its work.

Where a patient has a history of previous deep thrombosis, and has enlarged superficial veins, it is essential to decide firstly, whether or not the deep veins have become patent again, and secondly, whether blood flow in the enlarged superficial veins is towards the heart or towards the periphery. The desired information can be gained by using the tourniquet test of Ochsner and Mahorner. This is a most useful test in examining any varicose vein patient, and I was surprised that Dr. Lawes made no reference to it. In a patient with obliterated deep veins and "compensatory" superficial veins, exercise with a tourniquet in position should cause the superficial veins to become grossly engorged. This effect is seen in the arm every time a tourniquet is used to facilitate venepuncture, the reason in this instance being that the upper extremity lacks the elaborate system of valved communicating veins which abound in the leg for the purpose of allowing blood to pass from the superficial to the deep veins and thus take advantage of the muscular pump action.

Alternatively, should the patient's leg when constricted during exercise not become congested, and even more strikingly should the superficial veins empty, then it is reasonable to conclude that the deep system is functioning. In such a patient removal of the tourniquet is seen to be followed by rapid refilling of the superficial veins from above, demonstrating the "paradoxical" direction of their blood flow.

Findings along these lines justify one in giving consideration to the advisability of sclerosing the varicose superficial veins, but first the patient's symptoms and signs must be weighed carefully to decide which of them are due to the varicose veins and which to the previous deep thrombosis. Marked œdema, as shown by R. T. Payne and others, is due to persistent lymphatic obstruction, and will not be cured by treating the veins, though it may indirectly be somewhat relieved.

If the effects fairly attributable to the varicose veins are distressing the patient, then treatment of these by injection,

or ligation *plus* injection, is indicated, but it is wise to proceed cautiously and to employ diminished amounts of sclerosing agents.

I feel that the above approach is a logical one, and should supersede the time-honoured custom of abandoning to their fate those patients with varicose veins and a history of previous deep thrombosis, in the fear that the superficial veins "may be compensatory".

In every one of these patients whom I have examined the tourniquet test has indicated patent deep veins, and I am coming to believe that in deep thrombosis the blockage of the veins is only temporary, and that recanalization always occurs in time. I would venture to suggest to Dr. Lawes that examination of the patient mentioned in the paragraph quoted above would have shown that the deep veins were no longer obliterated, but were carrying their quota of blood.

The long-term tragedy of deep thrombosis lies in the swelling of the leg which is due to lymphatic obstruction, and for which external elastic support offers a poor best in treatment. Let us not, for want of careful examination and reasoning, withhold treatment from those sufferers who also have varicose and not "compensatory" veins.

Yours, etc.,

225, Macquarie Street, Sydney. S. L. SPENCER.

November 25, 1946.

The Royal Australasian College of Physicians.

NINTH ANNUAL MEETING.

THE ninth annual meeting of the Royal Australasian College of Physicians will take place in Adelaide on Thursday and Friday, May 1 and 2, 1947.

Examination for Membership.

An examination for membership of the Royal Australasian College of Physicians will take place in March-April, 1947. The written examination will be held in capital cities of the Commonwealth where candidates are offering. The clinical examination will take place in both Sydney and Adelaide. Only those candidates whose answers in the written examination have attained a standard satisfactory to the Board of Censors will be allowed to proceed to the clinical examination.

The written examination will be conducted in capital cities on Saturday, March 29, 1947. The clinical examination will be conducted in Sydney on Tuesday, Wednesday and Thursday, April 22, 23 and 24, 1947, and in Adelaide on Tuesday and Wednesday, April 29 and 30, 1947.

Applications to appear before the Board of Censors should be made in the prescribed form and must be in the hands of the Honorary Secretary of the College not later than Saturday, March 1, 1947. Application forms are obtainable from the Honorary Secretary, 145, Macquarie Street, Sydney.

Obituary.

THOMAS ALEXANDER WILSON.

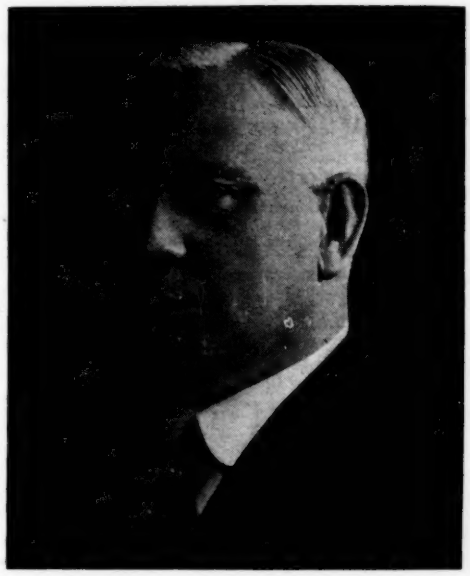
WE are indebted to Dr. R. C. Brown for the following appreciation of the late Dr. Thomas Alexander Wilson.

Dr. Thomas Alexander Wilson died suddenly at his home in Glenferrie Road, Kooyong, on May 17, 1946, after a short period of failing health due to cardiac disability.

He was the eldest of the family of Mr. and Mrs. Joseph Wilson, who were early pioneers of the Lancefield district where he was born in 1868. A boarder at Scotch College, Tom Wilson became a member of the crew and athletics champion of the school in 1887, after being runner-up the previous year. He also distinguished himself in sport at the University of Melbourne and was an earnest student, obtaining the University Exhibition in pathology and regional anatomy in his fourth year.

He qualified in 1893, and was soon appointed house surgeon to the Creswick Hospital, where he remained for five years and then settled in the town where he practised his profession till his retirement in 1920. In 1898 he married Miss J. E. Graham, the daughter of a prominent resident of Creswick, and after twenty-seven years of practice the couple, with their young family, came to live in Melbourne. Dr. Wilson then devoted the remainder of his life to his home in Kooyong and the management of the family property at Lancefield.

Though conducting a busy practice at Creswick, his public interests were very wide and varied and his personal interest in the lives of so many of the residents made him a noted figure in the district, where he was generally regarded with respect and affection. He was thrice mayor of the town, past junior grand warden of the Masonic Lodge and elder of the Presbyterian Church and President of the Ballarat Subdivision of the Victorian Branch of the British



Medical Association. Later, though living in Melbourne, he retained his enthusiasm in the affairs and people of Creswick—a district which plainly held an abiding place in his regard.

Tom Wilson was always noted for his kindly disposition. He was of a humorous turn of mind and told a good story and made a good after-dinner speech. His old university colleagues will miss the cheery characteristic Christmas card with appropriate literary quotation which custom led them to expect regularly. His many friends sincerely sympathize with Mrs. Wilson and her daughters and with his two sisters and brother in the loss of an affectionate husband, father and brother.

Australian Medical Board Proceedings.

NEW SOUTH WALES.

THE undermentioned have been registered, pursuant to the *Medical Practitioners Act*, 1938-1939, of New South Wales, as duly qualified medical practitioners:

Adams, Corona Mary Monk, M.B., B.S., 1946 (Univ. Sydney), Parramatta District Hospital, Parramatta.

Addison, Margaret Joan Wilton, M.B., B.S., 1946 (Univ. Sydney), 19, Hunter Road, Mosman.

Allsop, John Leslie, M.B., B.S., 1946 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.

Austin, John Charles, M.B., B.S., 1946 (Univ. Sydney), Manly District Hospital, Manly.

Basser, Leon Samuel, M.B., B.S., 1946 (Univ. Sydney), Sydney Hospital, Sydney.

Bauer, Gaston Egon, M.B., B.S., 1946 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.

Bear, Leonard Alexander, M.B., B.S., 1946 (Univ. Sydney), Cessnock District Hospital, New South Wales.

Bear, Victor David, M.B., B.S., 1946 (Univ. Sydney), Lewisham Hospital, Lewisham.
Benedek, Stephen, M.B., B.S., 1946 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.
Billington, Brian Price, M.B., B.S., 1946 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.
Blackman, John Edward, M.B., B.S., 1946 (Univ. Sydney), Sydney Hospital, Sydney.
Bleasel, Kevin Fabian, M.B., B.S., 1946 (Univ. Sydney), Saint Vincent's Hospital, Darlinghurst.
Brathwaite, Patricia Constance, M.B., B.S., 1946 (Univ. Sydney), Sydney Hospital, Sydney.
Burfitt-Williams, Grosvenor Charles Thomas, M.B., B.S., 1946 (Univ. Sydney), Lewisham Hospital, Lewisham.
Burke, William John Gerard, M.B., B.S., 1946 (Univ. Sydney), Saint Vincent's Hospital, Darlinghurst.
Cahalan, Bernard Joseph Seymour, M.B., B.S., 1946 (Univ. Sydney), Lewisham Hospital, Lewisham.
Calnan, Gordon Sylvester, M.B., 1946 (Univ. Sydney), Base Hospital, Grafton.
Campbell, Colin Alexander Kemp, M.B., B.S., 1946 (Univ. Sydney), Rosebery, via Zeehan, Tasmania.
Cary, Wilfred Hezlet, M.B., B.S., 1946 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.
Chesterfield-Evans, Hugh Harvey, M.B., B.S., 1946 (Univ. Sydney), Sydney Hospital, Sydney.
Colman, John Victor Leonard, M.B., B.S., 1946 (Univ. Sydney), Sydney Hospital, Sydney.
Cowlishaw, John Abbott, M.B., B.S., 1946 (Univ. Sydney), Royal North Shore Hospital, St. Leonards.
Davidson, Roger Madgwick, M.B., B.S., 1946 (Univ. Sydney), Marrickville District Hospital, Marrickville.
Daymond, Keith Robertson, M.B., B.S., 1946 (Univ. Sydney), Royal North Shore Hospital, St. Leonards.
de Monchaux, Robert Joseph, M.B., B.S., 1946 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.

QUEENSLAND.

THE undermentioned have been registered, pursuant to the provisions of *The Medical Acts, 1939 to 1940*, of Queensland, as duly qualified medical practitioners:

Bailey, Alan William Hale, M.B., B.S., 1941 (Univ. Sydney), Westwood Sanatorium, Westwood, via Rockhampton.
Chambers, Alfred Williams, L.R.C.P. and S., 1942 (Edinburgh), L.R.F.P. and S., 1942 (Glasgow), F.R.C.S., 1945 (Edinburgh), 15, Crescent Road, Kelvin Grove, Brisbane.
Cockburn, Keith Gordon, M.B., B.S., 1945 (Univ. Sydney), 905, Stanley Street, Brisbane.
Follent, John William, M.B., B.S., 1940 (Univ. Sydney), Tweed Street, Tweed Heads, New South Wales.

TASMANIA.

THE undermentioned have been registered, pursuant to the provisions of the *Medical Act*, 1918, of Tasmania, as duly qualified medical practitioners:

Foxton, Justin Richard Vernon, M.B., B.S., 1934 (Univ. Melbourne), Lachlan Park, New Norfolk.
Campbell, Colin Alexander Kemp, M.B., B.S., 1946 (Univ. Sydney), Rosebery, Tasmania.

Nominations and Elections.

THE undermentioned has applied for election as a member of the New South Wales Branch of the British Medical Association:

Oakley, Donald Waterhouse, M.B., B.S., 1941 (Univ. Sydney), 1, Glamis Flats, Ocean Avenue, Edgecliff.

THE FEDERAL MEDICAL WAR RELIEF FUND.

THE following contribution to the Federal Medical War Relief Fund has been received:

Western Australia.

J. P. Ainslie, £26 6s.
Grand total: £16,007 0s. 6d.

Books Received.

"Women in Industry: Their Health and Efficiency", by Anna M. Baetjer, Sc.D.; issued under the auspices of the Division of Medical Sciences and the Division of Engineering and Industrial Research of the National Research Council; 1946. Philadelphia and London: W. B. Saunders Company; Melbourne: W. Ramsay (Surgical) Proprietary Limited. 9¼" x 6", pp. 356. Price: 30s.

"Notes on Nursing: What It Is, And What It Is Not", by Florence Nightingale; a facsimile of the first edition published in 1860 by D. Appleton and Company, New York, with a foreword by Virginia M. Dunbar; 1946. New York, London: D. Appleton-Century Company Incorporated. 7¼" x 5", pp. 149. Price: $2.00.

Diary for the Month.

DEC. 17.—New South Wales Branch, B.M.A.: Medical Politics Committee.
DEC. 17.—New South Wales Branch, B.M.A.: Ethics Committee.
DEC. 20.—Queensland Branch, B.M.A.: Council Meeting.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Honorary Secretary, 135, Macquarie Street, Sydney): Australian Natives' Association; Ashfield and District United Friendly Societies' Dispensary; Balmain United Friendly Societies' Dispensary; Leichhardt and Petersham United Friendly Societies' Dispensary; Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney; North Sydney Friendly Societies' Dispensary Limited; People's Prudential Assurance Company Limited; Phœnix Mutual Provident Society.

Victorian Branch (Honorary Secretary, Medical Society Hall, East Melbourne): Associated Medical Services Limited; all Institutes or Medical Dispensaries; Australian Prudential Association, Proprietary, Limited; Federated Mutual Medical Benefit Society; Mutual National Provident Club; National Provident Association; Hospital or other appointments outside Victoria.

Queensland Branch (Honorary Secretary, B.M.A. House, 225, Wickham Terrace, Brisbane, B.17): Brisbane Associated Friendly Societies' Medical Institute; Bundaberg Medical Institute. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL or position outside Australia are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.

South Australian Branch (Honorary Secretary, 178, North Terrace, Adelaide): All Lodge appointments in South Australia; all Contract Practice appointments in South Australia.

Western Australian Branch (Honorary Secretary, 205, Saint George's Terrace, Perth): Wiluna Hospital; all Contract Practice appointments in Western Australia. All government appointments with the exception of those of the Department of Public Health.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

All communications should be addressed to the Editor, THE MEDICAL JOURNAL OF AUSTRALIA, The Printing House, Seamer Street, Glebe, New South Wales. (Telephones: MW 2651-2.)

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